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THE
EVOLUTION OF CULTURE
AND OTHER ESSAYS

BY THE LATE

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TWENTY-ONE PLATES

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PREFACE

These Essays, or rather Lectures, contain the first-fruits of the earliest systematic attempt to apply the theory of Evolution to the products of human handiwork. In their original form they have long been difficult to obtain; and they are reprinted now to supply the needs of candidates for the Oxford Diploma in Anthropology, and of the numerous visitors to the Pitt-Rivers Museum in Oxford. But they will certainly appeal to a far wider public also, as a brief and authentic statement of their author's discoveries.

The four Essays are reprinted substantially as they were first delivered and published. But verbal errors and actual misquotations have been corrected; and allusions to specimens or diagrams exhibited during the original discourses, but not published, have been replaced so far as possible by references to similar objects figured in the Plates.

The Plates are photographic reproductions of the original illustrations, with the exception of Plates V, XIII, XVII, XVIII. Of these, Plate XIII has simply been re-drawn, from a faded original; Plates XVII and XVIII have been translated, without loss of detail, from colours to monochrome shading; Plate V has been reconstituted from illustrations quoted in the text, with the permission of their publisher, Mr. Murray. Plate XXI is reproduced, by permission of Sir John Evans, from the paper which it illustrated originally.

The footnotes demand a word of explanation. The author, as the original publications show, was not precise in indicating his sources: he frequently gave, as a quotation, the general sense rather than the exact words of his authority; and occasionally his memory played him false. In the reprint, the precise references have been identified, and are given in full, and obvious errors in the text have been either amended or corrected in a footnote. The editor desires to acknowledge much valuable help in the search for references from Miss C. M. Prior, of Headington.

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INTRODUCTION[1]

It was about the middle of last century that an officer in Her Majesty's Army began to apply the lessons which he had learnt in the course of some of his professional experimental work to studies pursued by him as a hobby in a far wider field of science. The story of the famous ethnographical collection of Colonel Lane Fox is well known, and I need but briefly refer to it. During his investigations, conducted with a view to ascertaining the best methods whereby the service firearms might be improved, at a time when the old Tower musket was being finally discarded, he was forcibly struck by the extremely gradual changes whereby improvements were effected. He observed that every noteworthy advancement in the efficiency, not only of the whole weapon, but also of every individual detail in its structure, was arrived at as a cumulative result of a succession of very slight modifications, each of which was but a trifling improvement upon the one immediately preceding it. Through noticing the unfailing regularity of this process of gradual *evolution* in the case of firearms, he was led to believe that the same principles must probably govern the development of the other arts, appliances, and ideas of mankind. With characteristic energy and scientific zeal Colonel Lane Fox began at once, in the year 1851, to illustrate his views and to put them to a practical test. He forthwith commenced to make the ethnological collection with which his name will always be associated, and which rapidly grew to large proportions under his keen search for material which should illustrate and perhaps prove his theory of progress by evolution in the arts of mankind.

Although as a collector he was omnivorous, since every artefact product fell strictly within his range of inquiry, his collection, nevertheless, differed from the greater number of private ethnological collections, and even public ones of that day, inasmuch as it was built up *systematically* with a definite object in view. It is unnecessary for me to describe in detail the system which he adopted in arranging his collection. His principles are well known to ethnologists, either from the collection itself or from his writings, more especially from the series of lectures which he gave at the Royal United Service Institution, in the years 1867–9, upon 'Primitive Warfare'; from his paper read before the Anthropological Institute in 1874 on 'The Principles of Classification, as adopted in the arrangement of his Anthropological Collection', which was then exhibited at the Bethnal Green Museum; from that portion of the *catalogue raisonné* of his collection which was published in 1877; and from numerous other papers dealing with special illustrations of his theory. Suffice it to say that, in classifying his ethnological material, he adopted a *principal* system of groups into which objects of like form or function from all over the world were associated to form series, each of which illustrated as completely as possible the varieties under which a given art, industry, or appliance occurred. Within these main groups objects belonging to the same region were usually associated together in *local* sub-groups. And wherever amongst the implements or other objects exhibited in a given series there seemed to be suggested a *sequence of ideas*, shedding light upon the probable stages in the evolution of this particular class, these objects were specially brought into juxtaposition. This special grouping to illustrate sequence was particularly applied to objects from the same region as being, from their local relationships, calculated better to illustrate an actual continuity. As far as possible the seemingly more primitive and generalized forms—those simple types which usually approach most nearly to *natural* forms, or whose use is associated with primitive ideas—were placed at the beginning of each series, and the more complex and specialized forms were arranged towards the end.

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[1] Extracted from Mr. Henry Balfour's address to the Anthropological Section of the British Association at Cambridge in 1904.

The primary object of this method of classification by series was to demonstrate, either actually or hypothetically, the origin, development, and continuity of the material arts, and to illustrate the variations whereby the more complex and specialized forms belonging to the higher conditions of culture have been evolved by successive slight improvements from the simple, rudimentary, and generalized forms of a primitive culture.

The *earlier* stages in these sequence series were more especially the object of investigation, the later developments being in the greater number of cases omitted or merely suggested. It was necessary for Colonel Lane Fox to restrict the extent of the series, any one of which, if developed to the full extent, would easily have filled a good-sized museum. The earlier stages, moreover, were less familiar, and presented fewer complications. The general principles of his theory were as adequately demonstrated by the ruder appliances of uncivilized races as by the more elaborate products of peoples of higher culture; and, moreover, there was doubtless a great attraction in attacking that end of the development series which offered a prospect at least of finality, inasmuch as there was always a chance of discovering the absolute origin of a given series. Hence the major part of his collection consisted of specimens procured from savage and barbaric races, amongst whom the more rudimentary forms of appliances are for the most part to be found.

The validity of the general views of Colonel Lane Fox as to evolution in the material arts of Man was rapidly accepted by a large number of ethnologists and others, who were convinced by the arguments offered and the very striking evidence displayed in their support. I have heard people object to the use of the term 'evolution' in connexion with the development of human arts. To me the word appears to be eminently appropriate, and I think it would be exceedingly difficult to find one which better expresses the succession of extremely minute variations by means of which progress has been effected. That the successive individual units of improvement, which when linked together form the chain of advancement, *are* exceedingly small is a fact which any one can prove for himself if he will study *in detail* the growth of a modern so-called 'invention'. One reason why we are apt to overlook the greater number of stages in the growth of still living arts is that we are not as a rule privileged to watch behind the scenes. Of the numberless slight modifications, each but a trifling advance upon the last, it is but comparatively few which ever meet the eye of the public, which only sees the more important stages; those, that is to say, which present a sufficiently distinct advance upon that which has hitherto been in use to warrant their attracting attention, or, shall we say, having for a time a marketable value. The bulk of the links in the evolutionary chain disappear almost as soon as they are made, and are known to few, perhaps none, besides their inventors. Even where the history of some invention is recorded with the utmost care it is only the more prominent landmarks which receive notice; the multitude of trifling variations which have led up to them are not referred to, for, even if they be known, space forbids such elaborately detailed record. The smaller variations are, for the most part, utterly forgotten, their ephemeral existence and their slight individual influence upon the general progress being unrecorded at the time, and lost sight of almost at once. The immediately succeeding stage claims for the moment the attention, and it again in its turn becomes the stepping-stone upon which the next raises itself, and so on.

Before proceeding further, let me give as briefly as I can an example of a development series worked out, in the main, upon the general line of inquiry inaugurated by Colonel Lane Fox. It is commonly accepted as a fact, which is borne out by tradition, both ancient and modern, that certain groups of stringed instruments of music must be referred for their origin to the bow of the archer. The actual historical record does not help us to come to a definite conclusion on this point, nor does the direct testimony of archaeology; but from other sources very suggestive evidence is forthcoming. A comparative study of the musical instruments of modern savage and barbaric peoples makes it very clear to one that the greater portion of the probable chain of sequences which led from the simple bows to highly specialized instruments of the harp family may be reconstructed from types still existing in use among living peoples, most of the well-defined early stages being represented in Africa at the present day[1]. The native of Damaraland, who possesses no stringed instrument proper, is in the habit of temporarily converting his ordinary shooting-bow into a musical instrument. For this purpose he ties a small thong loopwise round the bow and bow-string, so as to divide the latter into two vibrating parts of unequal length. When lightly struck with a small stick the tense string emits a couple of notes, which satisfy this primitive musician's humble cravings for purely rhythmic sound. Amongst many other African tribes we find a slight advance, in the form of special, rather slightly made bows constructed and used for musical purposes only. In order to increase the volume of sound, it is frequently the custom amongst some of the tribes to rest the bow against some hollow, resonant body, such as an inverted pot or hollow gourd. In many parts again, we find that the instrument has been further improved by *attaching* a gourd to the bow, and thus providing it with a permanent resonating body. To achieve greater musical results, it would appear that somewhere in Africa (in the West, I suspect) two or more small bows were attached to a single gourd. I have, so far, been unable to trace this particular link in Africa itself, but, curiously enough, this very form has been obtained from Guiana. It may be thought that I am applying a breaking strain to the chain of evidence when I endeavour to work an instrument from South America into an African developmental series. But, when we recall the fact that evidence of the existence of *indigenous* stringed instruments of music in the New World has yet to be produced, coupled with the certain knowledge that a considerable number of varieties of musical instruments, stringed and otherwise, accompanied the enforced migration of African natives during the days of the slave trade, and were thus established in use and perpetuated in many parts of the New World, including the north-east regions of South America, we may, I think, admit, with some confidence, that, in this particular instance, from Guiana to Guinea is no very far cry, and that the more than probable African origin of this instrument from South America gives it a perfect claim to take its place in the African sequence. I still anticipate that this type of instrument will be forthcoming from some hinterland region in West Africa. Were *no* evidence at all forthcoming of such a form, either in past or present, we should be almost compelled to infer that such a one had existed, as this stage in the sequence appears to be necessary to prevent a break in the continuity of forms leading to what is apparently the next important stage, represented by a type of instrument common in West Africa, having five little bows, each carrying its string, all of which are fixed by their lower ends into a box-like wooden resonator. This method of attaching the bows to the now improved body of the instrument necessitates the lower attachment of the strings being transferred from the bows to the body, so that the bow-like form begins to disappear. The next improvement, of which there is evidence from existing types, consists in the substitution of a single, stouter, curved rod for the five little 'bows', all the five strings being serially attached to the upper end of the rod, their lower ends to the body as before. This instrument is somewhat rare now, and it may well be a source of wonder to us that it has survived at all (unless it be to assist the ethnologist), since it is an almost aggressively inefficient form, owing to the row of strings being brought into two different places at right angles to one another. The structure of this rude instrument gives it a quaintly composite appearance, suggesting that it is a banjo at one end and a harp at the other. This is due to the strings remaining, as in the preceding form, attached to the resonating body in a line disposed *transversely*, while the substitution of a single rod for the five 'bows' has necessitated the disposal of their upper attachments in a *longitudinal* series as regards the longer axis of the instrument. Inefficient though it be, this instrument occupies an important position in the apparent chain of evolution, leading on as it does through some intermediate types to a form in which the difficulty as regards the strings is overcome by attaching their *lower* ends in a longitudinal series, and so bringing them into the same plane throughout their length. In this shape the instrument has assumed a harp-like form—a rude and not very effective one, it is true, but it is none the less definitely a member of the harp family. The modern varieties of this type extend across Africa from west to east, and the harps of ancient Egypt, Assyria, Greece, and India were assuredly elaborations of this primitive form. The Indian form, closely resembling that of ancient Egypt, still survives in Burma, while elsewhere we find a few apparently allied forms. In all these forms of the harp, from the rudest Central and West African types to the highly ornate and many-stringed examples of Egypt and the East, one point is especially noteworthy. This is the invariable *absence of the fore-pillar,* which in the modern harps of Western Europe is so important, nay, essential a structural feature. In spite of the skill and care exercised in the construction of some of the more elaborate forms, none were fitted with a fore-pillar, the result being that the frame across which the strings were stretched was always weak and disposed to yield more or less to the strain caused by the tension of the strings. This implied that, even when the strings were not unduly strained, the tightening up of one of them to raise its pitch necessarily caused a greater or less slackening of all the other strings, since the free end of the rod or 'neck' would tend to be drawn slightly towards the body of the instrument under the increased tension. The mere addition of a simple, strut-like support between the free end of the 'neck' and the 'body' would have obviated this difficulty and rendered the instrument relatively efficient and unyielding to varying tension. And yet, even in Western Europe, this seemingly obvious and invaluable addition did not appear, as far as I can ascertain, until about the seventh or eighth century A.D.; and even then it seems to have been added somewhat half-heartedly, and a very long time had yet to elapse before the fore-pillar became an integral part of the framework and was allotted its due proportion in the general design.

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[1] *The Natural History of the Musical Bow*, by H. Balfour: Clarendon Press, Oxford, 1899.

I have purposely selected this particular series for my illustration, not because it is something new—indeed, it is already more or less familiar, and, maybe, has even some merit in its lack of newness, since, in accordance with a popular dictum, it may urge a greater claim to be regarded as true—nor because it is specially striking, but rather for the reason that it illustrates suitably several of the points upon which I wish briefly to touch. Even in the severely condensed form in which I have been obliged to present this series of developments from bow to harp, there is, I think, demonstrated the practical application of several of the general principles upon which is based the theory whereby Colonel Lane Fox sought to elucidate the phenomena of human progress.

A series of this kind serves, in the first place, to demonstrate that the absence of historical and archaeological evidence of the *actual* continuity in development from simple to complex does not preclude investigations into the early history of any product of human ingenuity, nor prevent the formation of a suggestive and plausible if largely hypothetical series, illustrating the probable chain of sequences along which some highly specialized form may be traced back link by link to its rudimentary prototypes, or even to its absolute origin, which in this particular instance is the ordinary shooting bow *temporarily* converted into a musical instrument. Where an actual chronological series is not forthcoming, a comparative study of such types as are available, even though they be *modern* examples, reveals the fact that, if classified according to their apparent morphological affinities, these types show a tendency to fall into line; the gap between the extreme forms—that is, the most simple and the most advanced—being filled by a succession of intermediate forms, more or less completely linked together, according to the number of varieties at our disposal. We are thus, at any rate, in possession of *a* sequence series. Is it unreasonable for us to conclude that this reflects, in great measure, *the* actual chronological sequence of variations through which in past times the evolutionary history of the instrument was effected, from the earliest rudimentary form?

It is difficult to account, at all, for the existence of many of the forms, such as I have briefly described, except on the supposition that they are *survivals* from more or less *early stages* in a series of progressive evolution; and, for myself, I do not believe that so inefficient and yet so elaborate an instrument, as, to take an example, the harp of ancient Egypt, Assyria, and India, could have come into being by any sudden inventive process, by 'spontaneous generation', as it were, to use a biological term; whereas, the innate conservatism of the human species, which is most manifest among the lower and more primitive races (I use the term conservatism, I need hardly say, in a non-political sense), amply accounts for such forms having been arrived at, since the rigid adherence to traditional types is a prevailing characteristic of human culture, and only admits of improvement by very slight and gradual variations upon existing forms. The difficulty experienced by man, in a primitive condition of culture, of emancipating himself from the ideas which have been handed down to him, except by a very gradual and lengthy process, causes him to exert somewhat blindly his efforts in the direction of progress, and often prevents his seeing very obvious improvements, even when they are seemingly forced upon his notice. For instance, the early Egyptian, Assyrian, and Greek harps, as I have already stated, were destitute of a fore-pillar, and this remained the case for centuries, in spite of their actually existing in an environment of other instruments, such as the lyre and *trigonon*, which in their rigid, unyielding frames possessed, and even paraded, the very feature which was so essential to the harp, to enable it to become a really efficient instrument. The same juxtaposition of similar types, without mutual influence, may be seen in modern Africa among ruder forms of these instruments.

And yet, in spite of instances such as this—where a valuable feature suggested by one instrument has not been adopted for the improvement of another, even though the two forms are in constant use side by side—we must recognize that progress, in the main, is effected by a process of bringing the experience gained in one direction to bear upon the results arrived at in another. This process of grafting one idea upon another, or, as we may call it, the hybridization of ideas and experience, is a factor in the advancement of culture whose influence cannot be overestimated. It is, in fact, the main secret of progress. In the animal world hybridization is liable to produce *sterile* offspring; in the world of ideas its results are usually far different. A fresh stimulus is imparted, which may last through generations of fruitful descendants. The *rate* at which progress is effected increases steadily with the growth of experience, whereby the number of ideas which may act and react upon one another is augmented.

It follows, as a corollary, that he who would trace out the phylogenetic history of any product of human industry will speedily discover that, if he aims at doing so *in detail*, he must be prepared for disappointments. The tangle is too involved to be completely unravelled. The sequence, strictly speaking, is not in the form of a simple chain, but rather in that of a highly complex *system* of chains. The time-honoured simile afforded by a river perhaps supplies the truest comparison. The course of the *main stream* of our evolution series may be fairly clear to us, even as far as to its principal source; we may even explore and study the general effect produced by the more important tributaries; but to investigate in detail the contributions afforded in present and past of the innumerable smaller streams, brooks, and runlets is clearly beyond any one's power, even supposing that the greater number had not changed their course at times, and even, in many cases, run dry. While we readily admit that important effects have been produced by these numberless tributary influences, both on the course and on the volume of the river, it is clear that we must in general be content to follow the main stream. A careful study of the series of musical instruments, of which I gave but a scanty outline, reveals very clearly that numberless ideas borrowed from outside sources have been requisitioned, and have affected the course of development. In some cases one can see fairly clearly whence these ideas were derived, and even trace back in part their own phylogenetic history; but a complete analysis must of necessity remain beyond our powers and even our hopes.

It will have been observed that, in the example of a sequence series which I have given, the early developmental stages are illustrated entirely by instruments belonging to *modern savage races*. It was a fundamental principle in the general theory of Colonel Lane Fox that in the arts and customs of the still living savage and barbaric peoples there are reflected to a considerable extent the various strata of human culture in the past, and that it is possible to reconstruct in some degree the life and industries of Man in prehistoric times by a study of existing races in corresponding stages of civilization. His insistence upon the importance of bringing together and comparing the archaeological and ethnological material, in order that each might serve to throw light upon the other, has proved of value to both sciences. Himself a brilliant and far-seeing archaeologist as well as ethnologist, he was eminently capable of forming a conclusion upon this point, and he urged this view very strongly.

The Earth, as we know, is peopled with races of the most heterogeneous description, races in all stages of culture. Colonel Lane Fox argued that, making due allowance for possible instances of degradation from a higher condition, this heterogeneity could readily be explained by assuming that, while the progress of some races has received relatively little check, the culture development of other races has been retarded to a greater or less extent, and that we may see represented conditions of at least partially arrested development. In other words, he considered that in the various manifestations of culture among the less civilized peoples were to be seen more or less direct *survivals* from the earlier stages or strata of human evolution; vestiges of ancient conditions which have fallen out at different points and have been left behind in the general march of progress.

Taken together, the various living races of Man seem almost to form a kind of living genealogical tree, as it were, and it is as an epiphyte upon this tree that the comparative ethnologist largely thrives; while to the archaeologist it may also prove a tree of knowledge the fruit of which may be eaten with benefit rather than risk.

This certainly seems to be a legitimate assumption in a general way; but there are numerous factors which should be borne in mind when we endeavour to elucidate the past by means of the present. If the various gradations of culture exhibited by the condition of living races—the savage, the semi-civilized or barbaric, and the civilized races—could be regarded as accurately typifying the successive stages through which the higher forms of culture have been evolved in the course of the ages; if, in fact, the different modern races of mankind might be accepted as so many sections of the human race whose intellectual development has been arrested or retarded at various definite stages in the general progression, then we should have, to all intents and purposes, our genealogical tree in a very perfect state, and by its means we could reconstruct the past, and study with ease the steady growth of culture and handicrafts from the earliest simple germs, reflecting the mental condition of primaeval man, up to the highest manifestations of the most cultured races.

These ideal conditions are, however, far from being realized.

Intellectual progress has not advanced along a single line, but, in its development, it has branched off in various directions, in accordance with varying environment; and the tracing of lines of connexion between different forms of culture, as is the case with the physical variations, is a matter of intricate complexity. Migrations, with the attendant climatic changes, change of food, and, in fact, of general environment, to say nothing of the crossing of different stocks, transmission of ideas from one people to another, and other factors, all tend to increase the tangle.

Although in certain instances savage tribes or races show obvious signs of having *degenerated* to some extent from conditions of a higher culturedom, this cannot be regarded as the general rule, and we must always bear in mind the seemingly parodoxical truth that degradation in the culture of the lower races is often, if not usually, the direct result of contact with peoples in a far higher state of civilization.

There can, I think, be little doubt that Colonel Lane Fox was well justified in urging the view that most savage races are in large measure strictly *primitive*, survivals from early conditions, the development of their ideas having from various causes remained practically stationary during a very considerable period of time. In the lower, though not degenerate, races signs of this are not wanting, and while few, possibly none, can be said to be absolutely in a condition of arrested development, their normal progress is at a slow, in most cases at a *very* slow, rate.

Perhaps the best example of a truly primitive race existing in recent times, of which we have any knowledge, was afforded by the native inhabitants of Tasmania. This race was still existing fifty years ago, and a few pure-blooded survivors remained as late as about the year 1870, when the race became extinct, the benign civilizing influence of enlightened Europeans having wiped this extremely interesting people off the face of the earth. The Australians, whom Colonel Lane Fox referred to as being 'the lowest amongst the existing races of the world of whom we have any accurate knowledge', are very far in advance of the Tasmanians, whose lowly state of culture conformed thoroughly with the characteristics of a truly primitive race, a survival not only from the Stone Age in general, but from almost the earliest beginnings of the Stone Age. The difference between the culture of the Tasmanians and that of the Australians was far greater than that which exists between man of the 'River Drift' period and his Neolithic successors. The objects of everyday use were but slight modifications of forms suggested by Nature, involving the exercise of merely the simplest mental processes. The stone implements were of the rudest manufacture, far inferior in workmanship to those made by Palaeolithic man; they were never ground or polished, never even fitted with handles, but were merely grasped in the hand. The *varieties* of implements were very *few in number*, each, no doubt, serving a number of purposes, the function varying with the requirements of the moment. They had no bows or other appliances for accelerating the flight of missiles, no pottery, no permanent dwellings; nor is there any evidence of a previous knowledge of such products of higher culture. They seem to represent a race which was isolated very early from contact with higher races; in fact, before they had developed more than the merest rudiments of culture—a race continuing to live under the most primitive conditions, from which they were never destined to emerge.

Between the Tasmanians, representing in their very low culture the one extreme, and the most civilized peoples at the other extreme, lie races exhibiting in a general way intermediate conditions of advancement or retardation. If we are justified, as I think we are, in regarding the various grades of culture, observable among the more lowly of the still existing races of man, as representing to a considerable extent those vanished cultures which in their succession formed the different stages by which civilization emerged gradually from a low state, it surely becomes a very important duty for us to study with energy these living illustrations of early human history, in order that the archaeological record may be supplemented and rendered more complete. The material for this study is vanishing so fast with the spread of civilization that opportunities lost now will never be regained, and already even it is practically impossible to find native tribes which are wholly uncontaminated with the products, good or bad, of higher cultures.

The arts of living races help to elucidate what is obscure in those of prehistoric times by the process of reasoning from the known to the unknown. It is the work of the zoologist which enables the palaeontologist to reconstruct the forms of extinct animals from such fragmentary remains as have been preserved, and it is largely from the results of a comparative study of living forms and their habitats that he is able, in his descriptions, to equip the reconstructed types of a past fauna with environments suited to their structure, and to render more complete the picture of their mode of life.

In like manner, the work of the ethnologist can throw light upon the researches of the archaeologist; through it, broken sequences may be repaired, at least suggestively, and the interpretation of the true nature and use of objects of antiquity may frequently be rendered more sure. Colonel Lane Fox strongly advocated the application of the reasoning methods of biology to the study of the origin, phylogeny, and etionomics of the arts of mankind, and his own collection demonstrated that the products of human intelligence can conveniently be classified into families, genera, species, and varieties, and *must* be so grouped if their affinities and development are to be investigated.

It must not be supposed—although some people, through misapprehension of his methods, jumped at this erroneous conclusion—that he was unaware of the danger of possibly mistaking mere accidental resemblances for morphological affinities, and that he assumed that *because* two objects, perhaps from widely separated regions, appeared more or less identical in form, and possibly in use, they were necessarily to be considered as members of one phylogenetic group. On the contrary, in the grouping of his specimens according to their form and function, he was anxious to assist as far as possible in throwing light upon the question of the monogenesis or polygenesis of certain arts and appliances, and to discover whether they are exotic or indigenous in the regions in which they are now found, and, in fact, to distinguish between mere analogies and true homologies. If we accept the theory of the monogenesis of the human race, as most of us undoubtedly do, we must be prepared to admit that there prevails a condition of unity in the tendencies of the human mind to respond in a similar manner to similar stimuli. Like conditions beget like results; and thus instances of independent invention of similar objects are liable to arise. For this very reason, however, the arts and customs belonging to even widely separated peoples may, though apparently unrelated, help to elucidate some of the points in each other's history which remain obscure through lack of the evidence required to establish *local* continuity.

I think, moreover, that it will generally be allowed that cases of 'independent invention' of similar forms should be considered to have established their claim to be regarded as such only after exhaustive inquiry has been made into the possibilities of the resemblances being due to actual relationship. There is the alternative method of assuming that, because two like objects are widely separated geographically, and because a line of connexion is not immediately obvious, therefore the resemblance existing between them is fortuitous, or merely the natural result of similar forms having been produced to meet similar needs. Premature conclusions in matters of this kind, though temptingly easy to form, are not in the true scientific spirit, and act as a check upon careful research, which, by investigating the case in its various possible aspects, is able either to prove or disprove what otherwise would be merely a hasty assumption. The association of similar forms into the same series has therefore a double significance. On the one hand, the sequence of related forms is brought out, and their geographical distribution illustrated, throwing light, not only upon the evolution of types, but also upon the interchange of ideas by transference from one people to another, and even upon the migration of races. On the other hand, instances in which two or more peoples have arrived independently at similar results are brought prominently forward, not merely as interesting coincidences, but also as evidence pointing to the phylogenetic unity of the human species, as exemplified by the tendency of human intelligence to evolve independently identical ideas where the conditions are themselves identical. Polygenesis in his inventions may probably be regarded as testimony in favour of the monogenesis of Man.

I have endeavoured in this review to dwell upon some of the main principles laid down by Colonel Lane Fox as a result of his special researches in the field of Ethnology, and my object has been twofold. First, to bear witness to the very great importance of his contribution to the scientific study of the arts of mankind and the development of culture in general, and to remind students of Anthropology of the debt which we owe to him, not only for the results of his very able investigations, but also for the stimulus which he imparted to research in some of the branches of this comprehensive science. Secondly, my object has been to reply to some criticisms offered in regard to points in the system of classification adopted in arranging his ethnographical collection. And, since such criticisms as have reached me have appeared to me to be founded mainly upon misinterpretation of this system, I have thought that I could meet them best by some sort of restatement of the principles involved.

It would be unreasonable to expect that his work should hold good in all details. The early illustrations of his theories were to be regarded as tentative rather than dogmatic, and in later life he recognized that many modifications in matters of detail were rendered necessary by new facts which had since come to light. The crystallization of solid facts out of a matrix which is necessarily partially volatile is a process requiring time. These minor errors and the fact of our not agreeing with all his details in no way invalidate the general principles which he urged, and we need but cast a cursory glance over recent ethnological literature to see how widely accepted these general principles are, and how they have formed the bases of, and furnished the inspiration for, a vast mass of research by ethnologists of all nations.

HENRY BALFOUR.

PRINCIPLES OF CLASSIFICATION

(1874)[1]

I GLADLY avail myself of the opportunity that has been afforded me of explaining the principles of classification that I have adopted in the arrangement of my collection, in the hopes that, by offering them to the consideration of anthropologists, their soundness may be put to the test, and that they may elicit criticism on the part of those who have devoted their attention to the subject of primitive culture.

The collection is divided into four parts. The first has reference to physical anthropology, and consists of a small collection of typical skulls and hair of races. This part of the collection, as it relates to a subject that has received a large amount of attention from anthropologists, and has been frequently treated by abler hands than mine, I do not propose to enter into. The remainder of the collection is devoted to objects illustrating the development of prehistoric and savage culture, and consists of—Part II. The weapons of existing savages. Part III. Miscellaneous arts of modern savages, including pottery and substitutes for pottery; modes of navigation, clothing, textile fabrics, and weaving; personal ornament; realistic art; conventionalized art; ornamentation; tools; household furniture; musical instruments; idols and religious emblems; specimens of the written character of races; horse furniture; money and substitutes for money; fire-arms; sundry smaller classes of objects, such as mirrors, spoons, combs, games, and a collection of implements of modern savages, arranged to illustrate the mode of hafting stone implements. Part IV refers to the prehistoric series, and consists of specimens of natural forms simulating artificial forms, for comparison with artificial forms; a collection of modern forgeries for comparison with genuine prehistoric implements; palaeolithic implements; neolithic implements; implements of bronze, iron, and bone.

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[1] A Paper read at a Special Meeting of the Anthropological Institute of Great Britain and Ireland on July 1, 1874, on the occasion of the opening of the Anthropological Collection to the public: and published in the *Journal of the Anthropological Institute*, iv (1875), pp. 293–308.

The collection does not contain any considerable number of unique specimens, and has been collected during upwards of twenty years, not for the purpose of surprising any one, either by the beauty or value of the objects exhibited, but solely with a view to instruction. For this purpose ordinary and typical specimens, rather than rare objects, have been selected and arranged in sequence, so as to trace, as far as practicable, the succession of ideas by which the minds of men in a primitive condition of culture have progressed from the simple to the complex, and from the homogeneous to the heterogeneous.

Many ethnological museums exist in this country and elsewhere, and therefore, in claiming to have accomplished a useful purpose in forming this collection, I am bound to endeavour to show that it performs some function that is not performed by the majority of the other museums that are to be found. I propose, therefore, to consider, in the first place, what the defect of an ethnological museum usually is.

The classification of natural history specimens has long been a recognized necessity in the arrangement of every museum which professes to impart useful information, but ethnological specimens have not generally been thought capable of anything more than a geographical arrangement. This arises mainly from sociology not having until recently been recognized as a science, if indeed it can be said to be so regarded by the public generally at the present time. Travellers, as a rule, have not yet embraced the idea, and consequently the specimens in our museums, not having been systematically collected, cannot be scientifically arranged. They consist of miscellaneous objects brought home as reminiscences of travel, or of such as have been most easily procured by sailors at the seaports. Unlike natural history specimens, which have for years past been selected with a view to variety, affinity, and sequence, these ethnological *curiosities*, as they have been termed, have been chosen without any regard to their history or psychology, and, although they would be none the less valuable for having been collected without influence from the bias of preconceived theories, yet, not being supposed capable of any scientific interpretation, they have not been obtained in sufficient number or variety to render classification possible.

This does not apply with the same force to collections of prehistoric objects, which during the last ten or fifteen years have received better treatment. It is to the arts and implements of modern savages that my remarks chiefly relate.

Since the year 1852 I have endeavoured to supply this want by selecting from amongst the commoner class of objects which have been brought to this country those which appeared to show connexion of form. Whenever missing links have been found they have been added to the collection, and the result has been to establish, however imperfectly, sequence in several series.

The primary arrangement has been by form—that is to say, that the spears, bows, clubs, and other objects above mentioned, have each been placed by themselves in distinct classes. Within each there is a sub-class for special localities, and in each of these sub-classes, or wherever a connexion of ideas can be traced, the specimens have been arranged according to their affinities, the simpler on the left and the successive improvements in line to the right of them. This arrangement has been varied to suit the form of the room, or of the screens, or the number of specimens, but in all cases the object kept in view has been, as far as possible, to trace the succession of ideas.

This is the distinctive difference between my collection and most others which I have seen, in which the primary arrangement has been geographical, that is to say, all the arts of the same tribe or nation have been placed together in one class, and within this there may perhaps have been in some cases a sub-class for special arts or special forms. Both systems have their advantages and disadvantages. By a geographical or racial arrangement the general culture of each distinct race is made the prominent feature of the collection, and it is therefore more strictly *ethnological*, whereas in the arrangement which I have adopted, the development of specific ideas and their transmission from one people to another, or from one locality to another, is made more apparent, and it is therefore of greater *sociological* value. Different points of interest are brought to light by each, and, in my judgement, a great National Anthropological Collection, should we ever possess such a desideratum, can never be considered complete until it embraces two series, arranged upon these two distinct systems.

Following the orthodox scientific principle of reasoning from the known to the unknown, I have commenced my descriptive catalogue with the specimens of the arts of existing savages, and have employed them, as far as possible, to illustrate the relics of primaeval men, none of which, except those constructed of the more imperishable materials, such as flint and stone, have survived to our time. All the implements of primaeval man that were of decomposable materials have disappeared, and can be replaced only in imagination by studying those of his nearest congener, the modern savage.

This being the system adopted, one of the first points to which I desire to invite your attention is the question, to what extent the modern savage truly represents primaeval man, or rather to what extent may we take the arts of modern savages to represent those of the first progenitors of our species?

In order to do this it is necessary to view the question in its psychological aspects. This I shall touch upon as lightly as possible, avoiding all technicalities, which in a cursory view of the matter, might tend to confuse, and confining myself to those parts of the subject which appear to have a direct bearing on evolution.

It is a matter of common observation that animals act by instinct, that is to say, that in the construction of their habitations and other arrangements for providing for their wants, they act intuitively, and apparently without the intervention of reason; and that the things which they construct, though often of a more or less complex character, are usually of a fixed type; that they are repeated by nearly all animals of the same kind with but little variety; and that within the limited space of time during which we are able to observe them, they do not appear to be susceptible of progress, although evidence has been adduced to show that animals, even in a wild state, do change their habits to a certain extent with the change of external conditions.

On the other hand, we recognize in many animals the operation of a reasoning mind. In their efforts to escape, or when conditions of a novel character are presented to them, they act in a manner that shows clear evidence of intelligence, although they show this to a very limited extent as compared with man.

We also know that habits acquired by animals during domestication, or taught them by the exercise of their reasoning faculties, become instinctive in them, and are inherited in their offspring, as in the familiar case of the pointer dog. We also know that under domestication animals lose the instincts acquired in a wild state.

In the human mind we recognize the presence of all these phenomena, only in a different degree. We are conscious of an intellectual mind capable of reasoning upon unfamiliar occurrences, and of an automaton mind capable of acting intuitively in certain matters without effort of the will or consciousness. And we know that habits acquired by the exercise of conscious reason, by constant habit, become automatic, and then they no longer require the exercise of conscious reason to direct the actions, as they did at first; as, for example, the habit of walking upright, which the child learns with pain and labour, but in time performs without conscious effort of the mind. Or the habit of reading and writing, the learning of which requires a strong and continuous effort of the intellect, but which in time becomes so completely automatic that it becomes possible to read a whole page aloud whilst the intellectual mind is conscious of being engaged in other things.

We perceive clearly that this automatic action of the brain is dependent on frequent repetition by the intellectual brain, as in the familiar case of learning by heart; and also that the transfer of the action from the intellectual to the automaton brain—if indeed there are separate portions of the brain allotted to these separate functions, as appears probable—is a gradual and not a sudden process, and that there are intermediate stages in which an action may be performed partly by direction of the intellect and partly automatically. This is shown in the case of a person who, wishing to make an effective speech at a public meeting, reasons out his address carefully, and then learns it partially by heart. When the time comes to address the assembly, the speech having been partly referred to the automaton brain, the intellect is relieved from action, and, being unoccupied, is apt to wander and engage itself in other matters that are passing at the time; but the automaton brain, being insufficiently prepared to bear the whole responsibility, is unable to continue, and the intellectual brain, having already started on a journey elsewhere, is unable to return quick enough to take up the thread of the discourse. The result is that the would-be orator breaks down pitiably in the middle of his speech, owing to his having learnt his lesson too well for one function of his mind, and not well enough for the other. The same is seen in many business transactions, which, from frequent repetition, become what is called a second nature, and in the conduct of which the conscious intellect is partly freed from the control of the actions.

We see also that both automatic and intellectual activity are inherited in different degrees by different persons. Thus it is a matter of common observation that there are some persons who are able to acquire with great facility the power of conversing upon simple subjects in many different languages, whilst upon more complex subjects, requiring intellectual effort, they never acquire the power of conversing in any language. Thus, also, it is frequently seen that some children show a remarkable aptitude for learning in their youth. It is said to be a pleasure to educate them; everything speedily becomes automatic in them; great hopes are entertained of their future prospects; but they frequently become a grievous disappointment to their parents, who have built castles in the air upon the strength of their apparent precocity, whereas an acute observer might have seen that they had never from the first showed signs of great intellectual capacity. On the other hand, we hear of dunces who are the despair of their tutors, who can with difficulty be taught to read and write and spell, but in after years become philosophers and scientists, all which might have been foretold from the first if the system of education had been such as to call forth the intellectual powers.

It is not merely that some inherit automatic capacity whilst in others the capacity is intellectual. There is, without doubt, in both cases an hereditary capacity for special things. Thus, whilst some acquire a knowledge of music with facility, others can never be made to appreciate a note of music, and so with respect to other arts.

How then are we to account for this innate indifference in the capacity of individuals, unless by supposing it to be proportioned to the length of time during which, or the degree of intensity with which, the ancestors of the individuals have had their minds occupied in the particular branch of culture for which capacity is shown? Unfortunately the difficulty of tracing the channel of hereditary transmission stands in the way of obtaining any certainty on this point, although the labours of our Vice-President, Mr. Galton, have already thrown much light on this interesting subject. But on this assumption, it is easy to account for the more perfect action of instinct in the lower animals than in men, when it is considered that the minds of their progenitors must have been confined to the experience of those particular things for which instinct is shown, far longer than is the case with man; and this brings us to the point which has an important bearing upon the question before us, viz. that every action which is now performed by instinct, has at some former period in the history of the species been the result of conscious experience.

But, in adopting this theory, it is not necessary to assume that the ideas themselves have been communicated by hereditary transmission. The doctrine of innate ideas, exploded by Locke, I believe, can never again establish itself. What is inherited is no doubt a certain organization of the nervous system, which, by repeated use through many generations, aided by natural selection, has become exquisitely adapted to the recognition of experience of a particular kind, and which, by the constant renovation that is going on within the body, has grown in harmony with those experiences, so that, when the spring is touched, as it were, the machinery is at once set in motion; but, until the necessary external conditions are presented to the mind, there can be no consciousness of them in the mind. The mind creates nothing apart from experience; its function is limited to building with the materials presented to it through the medium of the senses. The broader the basis of experience, the more lofty the superstructure that can be raised upon it. Or, to use the words of Mr. Herbert Spencer[1], 'the supposition that the inner cohesions are adjusted to the outer persistencies by accumulated experience of these outer persistencies, is in harmony with all our actual knowledge of mental phenomena. Though in so far as reflex actions and instincts are concerned, the experience hypothesis seems insufficient; yet, its seeming insufficiency occurs only where the evidence is beyond our reach. Nay, even here, such few facts as we can get, point to the conclusion that automatic physical connexions result from the registration of experiences continued for numberless generations.' And further on he says: 'In the progress of life at large, as in the progress of the individual, the adjustment of inner tendencies to outer persistencies must begin with the simple and advance to the complex, seeing that, both within and without, complex relations, being made up of simple ones, cannot be established before simple ones have been established.'

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[1] *The Principles of Psychology* (London, 1881), i.^{3} pp. 424–6.

From the foregoing considerations it follows that, in studying the evidence of intellectual progress, the phenomena which we may expect to observe are—firstly, a continuous succession of ideas; secondly, that the complexity of the ideas will be in an increasing ratio in proportion to the time; and thirdly, that the tendency to automatic action upon any given set of ideas will be in proportion to the length of time during which the ancestors of the individual have exercised their minds in those particular ideas. Hence it follows, as a corollary to this, that at the present time the tendency to automatic action will be greater in the lower animals than in the higher, because the minds of their progenitors have been exercised in the simple ideas, for which instinct is shown, for a greater length of time than those of the higher animals, amongst whom the simpler ideas have, at a comparatively recent period in the history of the race, been replaced, or otherwise modified, by ideas of a more complex character, which latter have not yet had time to become instinctive. And this is in accordance with what is practically observed in nature.

Now, in applying these principles to the study of progress in man, we must expect to find that the phenomena observed will be in proportion to the spaces of time we have to deal with in treating of man as compared with animals in general.

Assuming this psychological standard of humanity to have been at the level at which we find the highest of the lower animals that exist at the present time, we may suppose primaeval man to have been so far acquainted with the use of tools as to be able to employ a stone for the purpose of cracking the shells of nuts, but incapable of trimming the stone into any form that would answer his purpose better than that into which it had been shaped by rolling in a river bed or upon the seashore.

By the repeated use of stones for this and similar purposes, it would be found that, as Sir John Lubbock has pointed out, they sometimes split in the hand, and that the sharp edges of the fractured portions were more serviceable than the stones before fracture. By constant repetition of the same occurrence, there would grow up in the mind of the creature an association of ideas between the fracture of the stone and the saving of labour effected by the fractured portion, and also a sequence of ideas by which it would be perceived that the fracture of the stone was a necessary preliminary to the other, and ultimately, by still continued repetition, the creature would be led to perform the motions which had been found effectual in cracking the stone before applying it to the purposes for which it was to be used. So also in using the various natural forms of the branches of trees which fell into his hands, it would be found that particular forms were of use for particular purposes; and by constant repetition there would arise an association of ideas between those forms and the purposes for which they were useful, and he would begin to select them for such purposes; and in proportion to the length of time during which this association of ideas continued to exist in the minds of successive generations of the creatures which we may now begin to call men, would be the tendency on the part of the offspring to continue to select and use these particular forms, more or less instinctively—not, indeed, with that unvarying instinct which in animals arises from the perfect adaptation of the internal organism to external condition, but with that modified instinct which assumes the form of a *persistent conservatism*.

'The savage,' says Mr. Tylor, 'is firmly, obstinately conservative. No man appeals with more unhesitating confidence to the great precedent-makers of the past; the wisdom of his ancestors can control against the most obvious evidence of his own opinions and actions.'

In a similar manner mankind would be led to the conception of many other ideas, but of the majority of them no record would be preserved; it is only where the ideas have been associated with material forms that any record of them would be kept in prehistoric times; and this brings us to what I conceive to be the object of an anthropological collection—to trace out, by means of the only evidence available, the sequence of ideas by which mankind has advanced from the condition of the lower animals to that in which we find him at the present time, and by this means to provide really reliable materials for a philosophy of progress. We may not be able to find in these objects any associations that may lead us to form an estimate of the highest aspirations of the mind at any period of its development, but their importance to anthropologists consists in their value as evidence. Affording us as they do the only available evidence of man in his most primitive condition, they are well worthy of our attention, in order that by studying their grammar, we may be able to conjugate their forms.

Yet, although our data are thus limited to the material arts of mankind, only a small portion of those of prehistoric races are available for our purpose. As already said, only those tools and implements which were constructed of durable materials have remained; the rest have perished, and we have only the implements of existing savages by which to judge of them. The question, therefore, is, to what extent they may be taken as the representatives of the implements of prehistoric men, seeing that in point of time they are contemporaneous with the arts of the most civilized races, and not with those of prehistoric races.

Scattered over the world in various localities are savage races showing various degrees of culture, some higher and some lower than others, many of which have now been greatly influenced by contact with civilized races, but of the majority of which we have more or less detailed records, dating from the time of their first discovery by Europeans, when their arts may be regarded as indigenous, or, at any rate, free from any admixture with the arts of civilized races.

If these savage races have been degraded from a higher condition of culture, then, seeing that sequence of ideas is necessary to the existence of any ideas whatever, we must inevitably find traces in their arts of those higher arts from which they descended. But if, on the other hand, they have risen from a lower state, and their present savage condition arises from their having advanced less rapidly than those races which are now above them in the social scale, then what are the conditions which we must expect to find prevailing amongst them ?

We shall find, firstly, that the forms of their implements, instead of showing evidence of having been derived from higher and more complex forms, will, in proportion to the low state of their civilization, show evidence of being derived from natural forms, such as might have been employed by man before he had learnt the art of modifying them to his uses; and secondly, we shall find that the persistency of the forms is proportioned to the low state of their culture.

Now this is found to be the case with nearly every race of savages of whose condition we have any knowledge. Lowest amongst the existing races of the world of whom we have any accurate knowledge are the Australians. All their weapons assimilate to the forms of nature; all their wooden weapons are constructed on the grain of the wood, and consequently their curves are the curves of the branches out of which they were constructed. In every instance in which I have attempted to arrange my collection in sequence, so as to trace the higher forms from natural forms, the weapons of the Australians have found their place lowest in the scale, because they assimilate most closely to the natural forms.

Of this many examples may be given. I will not now again enter into the history of the boomerang, to which I have already drawn the attention of the Society on former occasions. Those who wish to see the subject treated in greater detail will find it discussed in my catalogue of the collection, in which are also given the authorities for many facts that are mentioned here, and which the limits of time and space do not enable me to quote at length. Suffice to say that the whole of the Australian weapons can be traced by their connecting links to the simple stick, such as might have been used by an ape or an elephant before mankind appeared upon this earth, and I have arranged them so as to show this connexion on the screens. Here also we are able to trace the development of the idea of a shield to cover the body, which in its simplest form is a simple parrying-stick held in the centre, and which expands gradually into an oval shield. It is also shown upon the screens how the simple waddy, or club with a lozenge-shaped head, by a gradual development of one side, grew into a kind of wooden hatchet, which ultimately became converted into a hatchet-boomerang.

The whole of the Australian weapons, without exception, are of this simple character, and in proof of the persistency with which this nation has continued to employ the same forms, no further evidence is necessary than the fact that they are the same, with but slight variations, over the whole continent. The slight differences between them, as Mr. Oldfield has pointed out, are so minute as scarcely to be perceptible to a European, but sufficient to enable a native to determine at a glance from what locality any specimen that may be shown him has been obtained.

But although all the connecting forms between the forms of nature and the more advanced forms are found amongst the *existing* weapons of these savages, we are not to assume from this that the whole of the progress observed has been effected in modern times. The whole sequence of ideas connecting these weapons (which are now constructed in a manner to show that the art of producing them is partly automatic) was reasoned out by such processes of the mind as stood for reason, at various former periods in the history of the race, each successive improvement constituting a link in the chain of progressive development. Each link has left its representatives, which, with certain modifications, have survived to the present time; and it is by the means of these *survivals*, and not by the links themselves, that we are able to trace out the sequence that has been spoken of.

This is the hypothesis put forward, and which I profess to justify by the facts accumulated in this collection.

Every form marks its own place in sequence by its relative complexity or affinity to other allied forms, in the same manner that every word in the science of language has a place assigned to it in the order of development or phonetic decay.

If there is such a thing as a science of language, and none can doubt it, who shall affirm that there is no such thing as a science of the arts? Language, it is true, embraces a wider sphere, and includes the arts; but, on the other hand, it is liable to sources of uncertainty for the purposes of science, from which the arts are free. Language is impalpable, invisible to the eye, except through the medium of a written character, which may or may not accurately express the sounds, and subject to acoustic changes in the collection of the materials, which are a perpetual cause of error and misclassification.

In tracing the development of the material arts, on the other hand, we have, in the earliest periods, the support of collateral evidence afforded by the fauna with which they are associated and by geological sequence, all which is wanting in the science of language.

Why, then, has language hitherto received more scientific treatment than the arts? Merely on account of the greater facility with which the data are collected. Whilst words take seconds to record, hours and days may be spent in the accurate delineation of form. Words cost nothing, are packed in folios, transmitted by post, and stored on the shelves of every private library. A million classified words may be carried in the coat pocket without inconvenience, whilst a hundredth part of that number of material objects require a museum to contain them, and are accessible only to a few. This is the reason why the arts have never been subjected to those classifications which form the groundwork of a science.

Then, again, in approaching prehistoric times, or in studying modern savages who represent prehistoric man, language loses its persistency, or fails us altogether. Although, in an advanced stage of civilization, especially when it has been committed to writing, it affords the surest test of culture, this is certainly not the case with the lowest savages, amongst whom language changes so rapidly that even neighbouring tribes cannot understand one another. And if this is the case in respect to language, still more strongly does it apply to all ideas that are communicated by word of mouth. In endeavouring to trace back prehistoric culture to its root forms, we find that in proportion as the value of language and of the ideas conveyed by language diminishes, that of ideas embodied in material forms increases in stability and permanence. Whilst in the earliest phases of humanity the names for things change with every generation if not more frequently, the things themselves are handed down unchanged from father to son and from tribe to tribe, and many of them have continued to our own time, faithful records of the condition of the people by whom they were fabricated.

Of the antiquity of savages we at present know little or nothing; but when archaeologists have exhausted the antiquities of civilized countries, a wide and interesting field of research will be open to them in the study of the antiquities of savages, which are doubtless to be discovered in their surface and drift deposits; and if the stability of their form has been such as we have reason to believe, we shall then be able to arrive at something like certainty in respect to the degree of slowness or rapidity, as well as the order, in which they have been developed.

Leaving now the Australians, and turning to other existing races in a higher, though still in a low, stage of civilization, such as, for example, the Fijians, who at the time of their discovery were still in the stone age, we find, on examining the forms of their implements, that we are in a higher stratum of culture, the characteristics of which correspond exactly to what might have been expected to be found on the principle of gradual evolution. The forms of their tools and weapons present the same connexions of form between themselves as amongst those of the Australians, but they are of a more complex type, and are no longer directly traceable to the natural forms of the limbs of trees, &c. The links of connexion between weapons of the same kind are as close as before, but in their varieties they present forms so singular as scarcely to make it possible to infer that they were designed for the purposes of use. They appear rather to have varied through the instrumentality of some law of succession similar to that by which species of animals have been evolved. In many cases, indeed, the sequence of ideas has led to the use of forms that are absolutely unserviceable as weapons and tools, and human selection, corresponding to natural selection, appears to have retained for use only such forms as could be employed, whilst the others have been consigned to state purposes or applied to symbolic uses. In many cases we find that their clubs have been converted into the forms of animals' heads, and in all such cases (and there are several in the collection) we see, by grouping a sufficient number of like forms together, that those which are in the shape of animals' heads have not been designed for the purpose of representing animals' heads, but their forms have simply been evolved during the numerous variations which the weapon has undergone in the process of development, and when the idea of an animal's head suggested itself, it has merely been necessary to add an eye, or a line for the mouth, in order to give them the resemblance in question. Examples of this may be seen in the collection of specimens from Africa, New Caledonia, New Zealand, and Solomon Isles.

In ornamentation, the stability of form is very remarkable. Particular forms of ornamentation fix themselves on a tribe or nation, and are repeated over and over again with but little variation of detail, as, for example, in the case of the coil and broken coil ornaments amongst the New Zealanders and the inhabitants of New Guinea, which were probably derived from Assam, or the representation of the head of an albatross amongst the Indians of the north-west coast of North America, or that of a human head amongst the inhabitants of New Ireland.

In the transformations of this latter ornament, which I took occasion to bring to the notice of the meeting of the Anthropological Department of the British Association at Brighton in 1872[1], and which are represented in Plate IV, we see a remarkable example of degradation of form, produced by gradual changes, caused by these people in copying from one another until the original design is lost. The representation of a human figure is here seen to lose gradually its limbs and body, then the sides of the face, leaving only the nose and ears, and ultimately the nose only, which finally expands at the base, and is converted into the representation of a half moon. In this sequence we have an exact parallel to the transformations observed upon ancient British coins by Mr. Evans[2], by which a coin of Philip of Macedon, representing a chariot and horses, becomes converted by a succession of similar changes into the representation of a single horse, and ultimately into fragments of a horse. Other examples of similar transformations from other countries are also shown.

Amongst other advantages of the arrangement by form, is the facility it affords for tracing the distribution of like forms and arts, by which means we can determine the connexion that has existed in former times between distant countries, either by the spread of race, or culture, or by means of commerce. Thus I have been able to trace the distribution of the bow over a large area, with evidence of its having spread from a common centre.

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[1] Address to the Department of Anthropology—Report of the British Association, 1872 (London, 1873), p. 168.

[2] *The Coins of the Ancient Britons*, by John Evans, F.R.S. (1864), pp. 24–32.

In the Asiatic islands and the Pacific, the line of its southern boundary is very clearly defined, marking off as non-bow-using races the whole of the inhabitants of Australia except Cape York, Tasmania, and formerly New Zealand and New Caledonia. Above this line the use of the bow spread from the Asiatic isles, and its transmission to the Papuan and Polynesian isles is due to the Malays, the Malay word for it—viz. 'panna'—being used over the whole of the region in question with but slight variations.

In the southern hemisphere, where suitable materials for the construction of it are abundant, the bow is of the form of the arcus, or simple arch; but in the frigid regions to the north, there are large tracts in Europe, Asia, and America which are either totally destitute of trees, or covered with coniferous forests, yielding few if any woods that have sufficient spring for the construction of a bow, and there is reason to believe, from the traces of forests discovered at low levels beneath the soil in various places, that this inhospitable region extended more to the southward in ancient prehistoric times. In such a region it is unlikely that the invention of the bow should have originated, and when the knowledge of it was communicated from the south, it would be necessary to employ some other elastic material to combine with the stiff pinewood, and give it the necessary elasticity; hence the composite bow, which is the bow of the northern hemisphere, and which consists of a combination of wood and sinew, or wood and bone. In its varieties I have traced this bow over the whole of the northern hemisphere, including Lapland, Siberia, and the northern part of North America. It is the bow of the ancient Persians and Scythians. The northern people carried it into India and into China, and also eastward into America, where its distribution is traced in two channels, one extending along the region inhabited by the Esquimaux into Greenland, and the other along the west coast as far south as California; and throughout the region mentioned, its varieties show it to have sprung from a common prototype.

Here also I may select, from amongst other illustrations of the same kind that are to be found, a single example of the manner in which the implements of modern savages may be made to explain the construction of those of races of antiquity, described upon their monuments. Quivers for arrows do not admit of much variety by which to trace improvement, and for this reason they must have continued unchanged in form much longer than contrivances which were susceptible of development; but the combination of quiver and bow case in one, may be traced over the whole of the region of the composite bow, the sinews of which made it necessary that it should be kept dry. Mr. Rawlinson, in his *Five Great Monarchies of the Ancient Eastern World* (London, 1864, vol. ii. p. 57), gives an illustration of an Assyrian quiver taken from ancient sculptures at Khorsabad. 'It had an ornamental rod attached to it, which projected beyond the arrows and terminated in a pomegranate blossom or other similar carving. To this rod were attached the rings which received the strap by which it was suspended to the shoulders.' The learned author adds: 'It is uncertain whether the material of the quivers was wood or metal.' The conventional mode of representing these objects and the imperfect command which the Assyrians had over the hard stone of the sculptures, give to the majority of the objects represented, the appearance of having been constructed of some hard material, as is clearly seen in the case of the hair and drapery; but, on turning to the quivers now used by the Indians of California, we at once see that the material of the quiver is explained by the form and position of the above-mentioned rod, which is fastened on the outside of it for the purpose of keeping the *limp* skin bag that contains the arrows stiff and straight, and thereby enabling the bowman to draw out his arrows with the necessary rapidity. And this enables us clearly to understand why, as stated by Mr. Rawlinson, not a single example of a quiver was found in the Assyrian excavations. In the Californian, as in the Assyrian quivers, the rod extends beyond the quiver, and is probably intended to guard the arrows from injury.

It is unnecessary in this place to add to the number of examples. The object of this paper, as already stated, is to explain the principles of classification. For the evidence on which these principles are based I must refer you to the catalogue. Whether these principles of classification are correct or not is a matter of less consequence than the arrangement of the facts, by which every person is enabled to form his own idea of the manner in which progress has been evolved in early times.

Human ideas, as represented by the various products of human industry, are capable of classification into genera, species, and varieties, in the same manner as the products of the vegetable and animal kingdoms, and in their development from the homogeneous to the heterogeneous they obey the same laws. If, therefore, we can obtain a sufficient number of objects to represent the succession of ideas, it will be found that they are capable of being arranged in museums upon a similar plan.

The resemblance between the arts of modern savages and those of primaeval man may be compared to that existing between recent and extinct species of animals. As we find amongst existing animals and plants, species akin to what geology teaches us were primitive species, and as among existing species we find the representatives of successive stages of geological species, so amongst the arts of existing savages we find forms which, being adapted to a low condition of culture, have survived from the earliest times, and also the representatives of many successive stages through which development has taken place in times past. As amongst existing animals and plants, these survivals from different ages give us an outline picture of a succession of gradually improving species, but do not represent the true sequence by which improvement has been effected, so, amongst the arts of existing people in all stages of civilization, we are able to trace a succession of ideas from the simple to the complex, but not the true order of development by which those more complex arrangements have been brought about. As amongst existing species of animals, innumerable links are wanting to complete the continuity of structure, so amongst the arts of existing peoples there are great gaps which can only be filled by prehistoric arts. What the palaeontologist does for zoology, the prehistorian does for anthropology. What the study of zoology does towards explaining the structures of extinct species, the study of existing savages does towards enabling us to realize the condition of primaeval man. To continue the simile further, the propagation of new ideas may be said to correspond to the propagation of species. New ideas are produced by the correlation of previously existing ideas in the same manner as new individuals in a breed are produced by the union of previously existing individuals. And in the same manner as we find that the crossing of animals makes it extremely difficult to trace the channel of hereditary transmission of qualities in a breed, so the crossing of ideas in this manner makes it extremely difficult to trace the sequence of ideas, although we may be certain that sequence does exist as much in one case as in the other.

Continuing still further the simile, we find that, as in the breeding of animals, when the divergence of races has gone so far as to constitute what is called distinct species, they cannot interbreed, so when the development of ideas has run in distinct channels far enough to create a hiatus, no intercommunication can take place. Two men of very different culture may travel in the same coach together, and, though speaking the same language, may find themselves unable to communicate except upon commonplace topics in which the simple ideas are common to both. Or two nations in very different stages of civilization may be brought side by side, as is the case in many of our colonies, but there can be no amalgamation between them. Nothing but the vices and imperfections of the superior culture can coalesce with the inferior culture without break of sequence.

Progress is like a game of dominoes—like fits on to like. In neither case can we tell beforehand what will be the ultimate figure produced by the adhesions; all we know is that the fundamental rule of the game is *sequence*.

ON THE EVOLUTION OF CULTURE

(1875)[1]

If we accept the definition of the term science as 'organized common sense', we necessarily reject the idea of it as a 'great medicine' applicable only to particular subjects and inapplicable to others; and we assume that all those things which call forth the exercise of our common sense are capable of being scientifically dealt with, according as the knowledge which we pretend to have about them is based on evidence in the first place, and in the sequel is applied to the determination of what, for want of a better word, we call general laws.

But in using this term 'law', we do not employ it in the sense of a human law, as a regulating or governing principle of anything, but merely as deduction from observed phenomena. We use it in the sense of a result, rather than a cause of what we observe, or at most we employ it to express the operation of proximate causes; and of the ultimate causes for the phenomena of nature we know nothing at all.

Further, in this development of the principle of common sense it has been said that the inductive sciences pass through three phases, which have been termed the empirical, the classificatory, and the theoretical.

Of these, the first or empirical stage may be defined as representing that particular phase of unorganized common sense in which our knowledge is simply a record of the results of ordinary experience, such as might be acquired by any savage or uneducated person in his dealings with external nature.

But as this condition of knowledge might perhaps be denied the claim to be considered scientific, it might be better perhaps to extend the term so as to embrace all that can be included under a practical knowledge of the subjects treated, in which these subjects are studied for their own sakes, or on account of their practical uses to man, and not with a view to generalizing upon them.

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[1] A Lecture delivered at the Royal Institution of Great Britain on Friday, May 28, 1875, and published in *Proc. Roy. Inst.*, vol. vii. pp. 496–520, Pl. i–iv.

In this way it may be said that agriculture represents the empirical or practical stage of botany; mining, that of geology; hunting and the domestication of animals, that of zoology; the trade of the butcher, that of anatomy; navigation by means of the stars, that of astronomy.

Passing now over the boundary line which separates what are generally recognized as the physical sciences from the science of culture, in which the subjects treated are emanations from the human mind, we find that these also have their corresponding phases of development.

Commencing first with the science of language, which has been the earliest and perhaps the most important branch of human culture the study of which has been scientifically treated as yet, we find that Professor Max Müller, in the series of lectures delivered in this Institution in 1861–3,[1] has shown that the science of language has its corresponding empirical or practical stage, in which it is studied only for its own sake, or for its utility as a means of intercommunication; not as a means of generalizing upon language as a whole, but merely for the purpose of understanding the particular languages which we wish to make use of in our intercourse with others.

In like manner passing from language to the particular department of culture which, for the reasons to be explained hereafter, I shall make the subject of this discourse, viz. the material arts, I shall endeavour to show that there exists also in relation to them a practical or empirical stage, which is the stage that we are now in with respect to them, in which we may include the whole of the constructive arts of mankind, from the simple flint knife to the most complex machine of modern times, when viewed from the standpoint of the mechanic or the artificer, not as subjects for generalization, but merely from an utilitarian point of view.

There are many persons no doubt who regard utility, not as a primary stage, but as the final and highest result of science. But the highest achievements of science, even the highest practical achievements, would never have been reached by the mere utilitarian. There is a force within us by which we are moved in the direction of acquiring knowledge for its own sake and for the sake of truth, regardless of any material advantage to be derived from such knowledge. Sooner or later such knowledge is sure to bear practical fruits, even though we may not live to realize them.

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[1] *Lectures on the Science of Language* (London, 1861), i, Lecture I.

It is in this spirit that men of science have advanced to the second or classificatory stage, in which, with a view to higher generalization, the subjects studied are grouped together according to their affinities, and specific points of resemblance are taken as the representatives of each class.

These classes are at first grouped round independent centres; but such an arrangement of them, having no existence in reality, is purely subjective and can only be transitional. The margins of the classes so formed represent only the margins of our knowledge or our ignorance, as the case may be.

By degrees, as the classes become extended, sub-classes are formed, and they are seen to arrange themselves in the form of branches radiating from a central stem. By still further observation, the stems of the several classes are seen to tend towards each other, and we are led to trace them to a point of union.

Thus from the classificatory or comparative we pass gradually into the third stage, which I have spoken of as the theoretical, but which may perhaps be more clearly defined as the evolutionary. By the use of this term 'evolutionary' we make it apparent that our third stage is but a development of the second, evolution being merely the necessary and inevitable result of the extension of classification, implying greater unity and broader generalizations.

These three stages then, the empirical or practical, the classificatory or comparative, and the evolutionary, are applicable to the development of all the inductive sciences.

But it has been held by some that a broad line of demarcation must be drawn between the physical sciences properly so called, such as zoology, botany, and geology, which deal with external nature, and those sciences which have been termed historic, which deal with the works of man.

This question has been ably treated by Professor Max Müller in the series of lectures to which I have referred, a course of lectures which must be regarded as a starting-point and basis of instruction for all who follow after him in the same path.

But in claiming for the science of language, and for language only, a place amongst the physical sciences, he has made admissions to opponents which, in my humble judgement, ought not to be made, and which are inconsistent with that more extended view of the subject by which I contend that, if language, then all that comes under the head of culture must be included amongst the physical sciences. Thus, for example, we find him admitting this passage as a sound and reasonable argument on the part of those who deny the claim of language to be included amongst the physical sciences: 'Physical science,' he says, 'deals with the work of God, historical science with the works of man.'

Now if in dealing with what are here termed the historical sciences, we were to take the subjects of such sciences, as for example the arts or language, implements or words, and were to regard them as entities to be studied apart from their relation to mind, and were to endeavour to deduce from them the laws by which they are related to each other, it is evident that we should be dealing with a matter which could not be correlated with the physical sciences; but such a course would be absurd. It would be as absurd to speak of a boomerang as being derived by inheritance from a waddy, as to speak of a word in Italian being derived by inheritance from a corresponding word in Latin; these words and these implements are but the outward signs or symbols of particular ideas in the mind; and the sequence, if any, which we observe to connect them together, is but the outward sign of the succession of ideas in the brain. It is the mind that we study by means of these symbols.

But of the particular molecular changes or other processes which accompany the evolution of ideas in the mind, we know no more than we do of the particular molecular changes and other processes which accompany the evolution of life in nature, or the changes in chemistry.

If then we are to understand the expression 'the work of God' as implying the direct action of ultimate causes, it is evident that we are not in a position either to affirm or to deny or to make any statement whatever respecting such ultimate causes, which may operate either as directly or as indirectly in the one case as the other. We know nothing about them, and therefore to invoke ultimate causes as a reason for distinguishing between the sciences is to take up a position which cannot be scientifically maintained.

With equal if not greater truth we may combat the assertion that the science of culture is historical, whilst nature, on the other hand, as dealt with by the physical sciences, is incapable of progress. However valid this objection might have appeared during the empirical and comparative stages of the physical sciences, it cannot be maintained, since the researches of Darwin and others have fairly landed them in their evolutionary phase. The principles of variation and natural selection have established a bond of union between the physical and culture sciences which can never be broken. History is but another term for evolution. There are histories and histories, as any one may determine who has read Green's *Short History of the English People*, and compared it with the kind of matter which passed for history in his school days. But our position with regard to culture has always been one which has forced on our comprehension the reality of progress, whilst with respect to the slow progress of external nature, it has been concealed from us, owing to the brief span of human existence and our imperfect records of the past. The distinction, therefore, between the sciences, as historical and non-historical, is but a subjective delusion, and not an objective reality; and herein, I believe, lies the secret of most of those errors that we have to contend with.

But the point in which I venture more particularly to differ from the conclusions of the learned author of the *Science of Language* is the line which he has drawn between language and the other branches of culture by including language amongst the physical sciences whilst he excludes the rest. 'If language,' he says, 'be the work of man in the same sense in which a statue, a temple, a poem, or a law, are properly called works of man, the science of language would have to be classed as an historic science'; and again he says, 'It is the object of these lectures to prove that language is not a work of human art in the same sense as painting, or building, or writing, or printing.'

In dealing with this question it is material, as regards the relative claims of language and the arts to be studied as physical sciences, to distinguish between the general and the particular. If it is said that language as a whole is not a work of human design, the same may with equal truth be said of the arts as a whole. A man who constructs a building, a tool, or a weapon, can no more be said to have devised a scheme of arts, than the introducer of a new word can be said to have invented a language; but each particular word bears the impress of human design as clearly as a weapon or a coin. A word may be said to be a tool for the communication of thought, just as a weapon is an implement of war.

But, says Professor Müller, 'art, science, philosophy, religion, all have a history; language or any other production of nature admits only of growth.' But unless it can be shown that words are entities having the power of generating and producing other words, which arts, tools, or weapons, do not possess, the word growth can only be applied figuratively to language as it is to the arts, and in that case growth and history are synonymous terms. But this is absurd. Words, as I said before, are the outward signs of ideas in the mind, and this is also the case with tools or weapons. Words are ideas expressed by sounds, whilst tools are ideas expressed by hands; and unless it can be shown that there are distinct processes in the mind for language and for the arts they must be classed together.

But it is said, 'language has the property of progressing gradually and irresistibly, and the changes in it are completely beyond the control of the free will of man.' This, however, can only be accepted relatively. We know that in certain phases of savage life the use of particular words may be tabooed in the same manner that the use of particular implements or weapons may be tabooed; but it would be quite as hopeless for any individual to attempt to change the entire course of the constructive arts as to change the form of a language; the action of the individual man is limited in both cases to the production of particular words or particular implements, which take their place like bricks in a building.

Man is not the designer in the sense of an architect, but he is the constructor in the sense of a brickmaker or a bricklayer.

But the difficulty of tracing fleeting words to their sources operates to a great extent in effacing the action of the individual in language. Words become public property before they are incorporated in a language. It would be difficult to establish a system of patents for new words. Here again we see that the line drawn between language and the arts is a subjective delusion, not an objective reality. It is not true that words do not originate with individual men, but merely that we do not perceive it.

Modifications of words, like modifications in the forms of the arts, result from the succession of ideas or other causes affecting particular minds. They obtain acceptance through natural selection by the survival of the fittest.

The chance which a new word or a new implement has of surviving depends on the number of words or implements to be superseded, on their relative importance to the art or the language, and the persistency with which these superseded words or implements are retained. The truth of this is seen in the fact that vocabularies change far more rapidly than grammatical forms; because the same grammatical terminations are employed with a large number of different words, and they are therefore a more constant necessity of speech.

Hence early and barbaric languages may be connected by their grammatical forms long after their vocabularies have entirely changed. The same truth is seen in the fact admitted by philologists, that in small communities new words and modifications of words gain more ready acceptance than in large communities; because the struggle of the new words for existence is less in small than in large communities, and the dialects therefore change more rapidly. And the same causes influence the transformations which take place in the arts. Objects in common use change more slowly than those which are but little employed; the difference is merely one of degree and not of kind.

In dealing with the arts, each separate contrivance occupies a larger share of our attention, to the exclusion of any comprehensive survey of them as a whole. The arts present themselves to our mental vision on a larger scale, and we view them analytically; we are as it were in the brickmaker's yard seeing each brick turned out of hand, whereas in dealing with language we see only the finished building; the details are lost. We view language synthetically. The arts may be said to present themselves to us as a sea beach in detached fragments; language in the form of a compact sandstone. The empiric or the utilitarian may deny that there is any resemblance between them; but the geologist knows that the mode of deposition has been the same in both cases, and he classes the whole as rocks.

Then again there are facilities for collecting and arranging the data for the study of language which do not exist in the case of the arts. Whilst words take seconds to record, hours and days may be spent in the accurate delineation of form. Words cost nothing, may be packed in folios, transmitted by post, and stored on the shelves of every private library. Ten thousand classified words may be carried in the coat pocket without inconvenience, whilst a tenth part of that number of material objects require a museum to contain them, and are accessible only to a few: this is the reason why the arts have never been subjected to those classifications which form the groundwork of a science.

But when we say that words and implements are both tools employed for the expression of thought, it is important to bear in view one difference between them, which has a practical bearing on the relative value of the two studies as a means of tracing the evolution of culture in prehistoric times and amongst savages. The word is the tool of the ear, the implement the tool of the eye; and for this reason language is the science of historic times, whilst the arts constitute the subject of science to be studied in relation to prehistoric times.

Every new tool or weapon formed by the hand of man retains the same form as long as it continues to exist; it may be handed from man to man, from tribe to tribe, from father to son, from one generation to another; or, buried in the soil, it may under special conditions continue for untold ages without change of form, until in our time it may be discovered and employed as evidence of the condition of the arts at the time it was fabricated. Very different, however, is the history of words. Each word coined by the exercise of the inventive faculty of man to express an idea is liable to change as it passes from mouth to ear. Its continued identity is dependent solely on memory, and it is subject to phonetic and acoustic changes from which the forms of the arts are exempt.

When by the invention of writing each word receives its equivalent in forms that are appreciable to the sense of sight, it gains stability, which places it on a footing of equality with the arts, and enables us to trace with certainty the changes it has undergone; and therefore in historic times language is the surest test of social contact that we can have. But in prehistoric times, before it had acquired this permanence through the invention of writing, the forms of language were, to use Mr. Sayce's expression, in a constant state of flux.

The truth of this is seen in the immense number of dialects and languages employed by savages at the present time. Thus amongst the one hundred islands occupied by the Melanesian race, the Bishop of Wellington tells us, and his statement is confirmed by the late lamented Bishop Patteson, that there are no less than two hundred languages, differing so much that the tribes can have but very little interchange of thought; and similar accounts are given of rapid changes of language in Cambodia, Siberia, Central Africa, North, Central, and South America.

The greater stability of the material arts as compared with the fluctuations in the language of a people in a state of primaeval savagery, is well shown by a consideration of the weapons of the Australians, and the names by which they are known in the several parts of that continent. These people, from the simplicity of their arts, afford us the only living examples of what we may presume to have been the characteristics of a primitive people. Their weapons are the same throughout the continent; the shield, the throwing-stick, the spear, the boomerang, and their other weapons differ only in being thicker, broader, flatter, or longer, in different localities; but whether seen on the east or the west coast, each of these classes of weapons is easily recognized by its form and uses. On the other hand, amongst the innumerable languages and dialects spoken by these people, it would appear that almost every tribe has a different name for the same weapon. The narrow parrying-shield, which consists of a piece of wood with a place for the hand in the centre, in South Australia goes by the name of 'heileman', in other parts it is known under the name of 'mulabakka', in Victoria it is 'turnmung', and on the west coast we have 'murukanye' and 'tamarang' for the same implement very slightly modified in size and form.

Referring to the comparative table of Australian languages compiled by the Rev. George Taplin, in the first number of the *Journal of the Anthropological Institute* (i, 1872, pp. 84–8), we find the throwing-stick, which on the Murray River is known by the name of 'yova', on the Lower Darling is 'yarrum', in New South Wales it is 'wommurrur', in Victoria 'karrick', on Lake Alexandrina 'taralye', amongst the Adelaide tribes of South Australia it is 'midla', in other parts of South Australia it is called 'ngeweangko', and in King George's Sound 'miro'.

From these considerations we arrive at the conclusion that in the earliest stages of culture the arts are far more stable than language: whilst the arts are subject only, or chiefly, to those changes which result from growth, language, in addition to those which result from growth, is also affected by changes arising from phonetic decay.

The importance therefore of studying the grammar, so to speak, of the arts becomes apparent, as it is by this means alone that we can trace out the origin and evolution of culture in the earliest times.

The task before us is to follow by means of them the succession of ideas by which the mind of man has developed, from the simple to the complex, and from the homogeneous to the heterogeneous; to work out step by step, by the use of such symbols as the arts afford, that law of contiguity by which the mind has passed from simple cohesion of states of consciousness to the association of ideas, and so on to broader generalizations.

This development has to be considered under the two heads of culture and constitution, that is to say, that we have to consider not only the succession of ideas in the mind resulting from experience, but also the development by inheritance of the internal organism of the mind itself, or, to use the words of Mr. Herbert Spencer, 'In the progress of life at large, as in the progress of the individual, the adjustment of inner tendencies to outer persistencies must begin with the simple and advance to the complex, seeing that, both within and without, complex relations, being made up of simple ones, cannot be established before simple ones have been established' (*Princ. of Psych.*, i^3, p. 426).

We find no difficulty in assenting to the general proposition that culture has been a work of progress. Our difficulty lies in realizing the slow stages of its early development, owing to the complexities both of our mental constitution and of the contemporaneous culture from which experience is drawn, or, again to use Mr. Spencer's more expressive words, of our 'inner tendencies', and 'outer persistencies'; we are apt to regard as intuitive, if not congenital, many simple ideas which in early culture can only have been worked out through the exercise of experience and reason during a long course of ages.

We see this error of our own minds constantly displayed in the education of children. The ideas in a child's mind, like those of mankind at large, are necessarily built up in sequence. The instructor makes use of some word, the meaning of which is clearly understood by him, but which does not fall into the sequence of the child's reasoning; the conception associated with it in the child's mind must, however, necessarily conform to such sequence. Hence a confusion of ideas, which is often attributed to the stupidity of the child, but which is in reality due to the inexperience of the instructor; as, for instance, in the case exemplified by Pip, in Dickens' *Great Expectations*, who, having imbibed the precept that he was to 'walk in the same all the days of his life', was led by his sequence of ideas to infer therefrom that he was invariably to walk to school by the same path, and on no account go round by the pastrycook's.

And so in studying savages and early races whose mental development corresponds in some degree to that of children, we have to guard against this automorphism, as Mr. Spencer terms it; that is to say, the tendency to estimate the capacity of others by our own, which appears almost completely to incapacitate some people from dealing with the subject.

The question of the free will of man enters largely into this study. I shall not be expected to say much upon a subject which has so lately occupied the attention of the public, having been discussed by some of our ablest scientists; but I cannot avoid quoting, in reference to this point, a passage from Dr. Carpenter's *Mental Physiology*, who in this controversy is certainly entitled to be regarded as the champion of free will; and therefore by quoting him we run no risk of overstating the case against free will. 'Our mental activity,' he says (p. 25), is 'entirely spontaneous or automatic, being determined by our congenital nervous organism. . . . It may be stated as a fundamental principle that the will can never originate any form of mental activity. . . .' But it has the power, he continues, of selecting any one out of several objects that present themselves either simultaneously or successively before the mental vision, and of so limiting and intensifying the impression which that particular object makes upon the consciousness, that all others shall be for the time non-existent to it.

The truth of this, in so far as regards the limitation of the will, cannot fail to force itself upon the student of culture. It is, I venture to think, by classifying and arranging in evolutionary order the actual facts of the manifestations of mind, as seen in the development of the arts, institutions, and languages of mankind, no less than by comparative anatomy, and far more than by metaphysical speculation, that we shall arrive at a solution of the question, to what extent the mental Ego has been, to use Professor Huxley's expression, a conscious spectator of what has passed.

I propose, therefore, with your permission, to give a few examples, by means of diagrams, of material evolution derived from the earliest phases of culture. In language and in all ideas communicated by word of mouth there is a hiatus between the limits of our knowledge and the origin of culture which can never be bridged over, but we may hold in our hand the first tool ever created by the hand of man.

It has been said that the use of speech is the distinctive quality of man. But how can we know that? We are literally surrounded by brute language. We can imitate their calls, and we find that animals will respond to our imitations of them. But who has ever seen any of the lower animals construct a tool and use it.

The conception of man, not as a tool-*using* but as a tool-*making* animal, is clear, defined, and unassailable; probably if we could trace language to its sources, we should be able to draw the same line between natural sounds employed as a medium of communication, and the created word. Thus the arts which we can study may perhaps be taken to illustrate the origin of language, which we cannot study in this phase.

The ape employs both sticks and stones as missiles and as hammers to crack the shells of nuts. But we have no evidence that he ever selects special forms for special uses. The arts therefore afford us a clearly defined starting-point for the commencement of culture.

To go in search of a particular form of stick or stone in order to apply it to a particular use would require greater effort of the will in fixing attention continuously on the matter in hand than is found to exist amongst the lower animals except in cases of instinct, which term I understand to mean an inherited congenital nervous organism which adapts the mind to the ready reception of experience of a particular kind. But this instinct does not exist in the case in question; there is no tool-making instinct: our tool has to be evolved through reason and experience, without the aid of any special organism for the purpose.

The process we have to assume therefore is that, in using stones as hammers, they would occasionally split. In using certain stratified rocks this would occur frequently, and so force itself on the attention of the creature. The creature going on hammering, it would force itself on his notice that the sharp fractured end was doing better work than before. It would be perceived that there were hard things and soft things, that the hard things split the stone, and the soft things were cut by it; and so there would grow up in the mind an association of ideas between striking hard things and splitting, and striking soft things and cutting, and also a sequence by which it would be perceived that the fracture of the stone was a necessary preliminary to the other; and in the course of many generations, during which the internal organism of the mind grew in harmony with this experience, the creature would be led to perform the motions which had been found effectual in splitting the stone before applying it to the purposes for which it was to be used.

Thus we arrive at a state of the arts in which we may suppose man to be able to construct a tool by means of a single blow. By constantly striking in the same direction, flakes would be produced; and by still further repeating the same motions, it would at last be found that by means of many blows a stone could be chipped to an edge or a point so as to form a very efficient tool.

But this continued chipping of the stone in order to produce a tool, implies a considerable mental advance upon the effort of mind necessary to construct a tool with one blow.

It implies continued attention directed by the will to the accomplishment of an object already conceived in the mind, and its subsequent application to another object which must also have been conceived in the mind before the tool was begun.

Now we know from all experience, and from all evolution which we can trace with certainty, that progress moves on in an accelerating ratio, and that the earlier processes take longer than the later ones.

But the implements of the drift, which are the earliest relics of human workmanship as yet recognized, are most of them multi-flaked tools, such as the implements figured on Plate XII, Nos. 1–10, requiring a considerable time to construct, and the use of innumerable blows in order to trim to a point at one end.

It appears therefore evident that in the natural course of events the drift period must have been preceded by an earlier period of considerable extent characterized by the use of single-flaked tools. And we may therefore consider it probable that should any evidences of man be hereafter discovered in miocene beds, they will be associated with such large rude flakes as those now exhibited, which require a feebler effort of attention and of reason to construct.

If we examine the forms of the flint implements of the drift, we find that out of many intermediate shapes we may recognize three in particular, which have been minutely described by Mr. Evans in his valuable work on the stone implements of Britain[1]: (1) a side-tool, consisting of a flint chipped to an edge on one side and having the natural rounded outside of the flint left on the other side, where it appears to have been held in the hand; (2) a tongue-shaped implement chipped to a point at one end, and having the rounded surface for the hand at the big end; and (3) an oval or almond-shaped tool, which is often chipped to an edge all round.

We have no evidence to show which of these kind of tools was the earliest; but that they were employed for different uses there can be little reason to doubt. But have we any evidence to throw light on the way in which these several forms originated in the minds of men in the very low condition of mental development which we may suppose to have existed at the time?

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[1] John Evans, *The Ancient Stone Implements, Weapons, and Ornaments of Great Britain* (London, 1872^1), 1897^2, p. 641.

About eight years ago, whilst examining the ancient British camps on the South Downs, I chanced to discover in the camp of Cissbury, near Worthing, a large flint factory of the neolithic age. There were some sixty or more pits from which flints had been obtained from the chalk, and these pits were full of the débris of the flint-workers. The factory was of the neolithic age, the most characteristic tool of which is the flint celt, a form which differs but slightly from the oval or almond-shaped palaeolithic form, but the cutting edge of which is more decidedly at the broad end. The débris, some six hundred or more specimens of which were collected, consisted chiefly of these celts in various stages of manufacture.

If any one will attempt to make a flint celt, as I have done sometimes (and Mr. Evans, from whom I learnt that art, has done frequently), he will find that it is difficult to command the fracture of the flint with certainty; every now and then a large piece will come off, or a flaw will be discovered which spoils the symmetry of the tool, and it has to be thrown away. In arranging and classifying the remains of this flint factory, I found that all the palaeolithic forms were represented by one or other of these unfinished celts, so much so as to make it doubtful whether some of them may not actually have been used like them.

A celt finished at the thin end, and abandoned before the cutting edge was completed, represented a tongue-shaped palaeolithic implement; a celt finished only on one side represented a palaeolithic side-tool; and a celt rudely chipped out, and abandoned before receiving its finishing strokes, represented almost exactly an oval palaeolithic tool, only differing from it in being somewhat rougher, and showing evidence of unfinish.

Taking a lesson then from this flint-worker's shop of the later neolithic age, we see how the earlier palaeolithic forms originated. They were not designed outright, as the nineteenth-century man would have designed them for special uses, but arose from a selection of varieties produced accidentally in the process of manufacture. The forms were also suggested by those of the nodules out of which they were made. We see, by examining the outside surfaces that were left on some of them, how a long thin nodule produced a long thin celt, a broad thick nodule a broad thick celt, and so forth. Indeed, so completely does the fabricator appear to have been controlled by the necessities of his art, that in tracing these successive forms one is almost tempted to ask whether the principle of causation lay mostly in the flint or in the flint-worker, so fully do they bear out the statement of Dr. Carpenter and the other physiologists, that nothing originates in the free will of man.

On these two diagrams (Plates I and II) I haves hown how, from the same form of palaeolithic implement already described, the more complex forms of the spear and axe-blade of the subsequent periods were developed. The point developed into a spear, and the broad end into an axe-blade. You will see by reference to Plate I that the oval tool of the drift suggested the smaller leaf-shaped spear-head of the early neolithic age. This, by a gradual straightening of the sides, became the lozenge-shaped form, which latter developed into the barbed form, and this last into the triangular form, which consists of barbs without a tang.

On the other hand, this same oval tool of the drift (Plate II), when used as an axe-blade with the broad end, became the celt of the neolithic period, chipped only at first and subsequently polished. This gave rise to the copper celt of the same form having convex surfaces, which grew into the bronze celt with flat sides. Then the bronze celt was furnished with a stop to prevent its being pressed too far into the handle by the blow. Others were furnished with projecting flanges to prevent them from swerving by the blow when hafted on a bent stick. Others had both stops and flanges. By degrees the flanges were bent over the stops and over the handle, and then the central portion above the stops, being no longer required, became thinner, and ultimately disappeared, the flanges closed on each other, and by this means the weapon grew into the socket celt. On this socket celt you will see that there is sometimes a semicircular ornamentation on each side. This semicircular ornament, as I pointed out in a paper on primitive warfare read some time ago, is a vestige of the overlapping flange of the earlier forms out of which it grew, which, like the rings on our brass cannon, are survivals of parts formerly serving for special uses (pp. 182–3 below).

In the vertical columns I have given, in the order of their occurrence, the successive periods of prehistoric time, viz. the early palaeolithic, late palaeolithic, early neolithic, late neolithic, early bronze, late bronze and iron periods, beneath which I have placed lines for two distinct phases of modern savage culture, viz. the Australian and the American Indian. A cross beneath each form denotes the periods in which they occur, and a vertical bar denotes that they are of rare or doubtful occurrence; so that the sequence of development may be seen at a glance, and it is only a glance that I ask you to take at these diagrams on the present occasion. I have checked them with Mr. Evans' work and also with Sir William Wilde's Catalogue,[1] and I do not think that any of the statements made in them will be challenged; but as these forms were not developed for the purpose of filling in the spaces in rectangular diagrams, such diagrams only imperfectly convey an idea of the evolution which has taken place, and must be regarded only as provisional and liable to be improved.

In tracing the evolution of prehistoric implements, we are of course limited to such as were constructed of imperishable materials. No doubt our prehistoric ancestors used also implements of wood, but they have long since disappeared; and if we wish to form an idea of what they were, we must turn to those of his nearest congener, the modern savage.

In speaking of savages, the question of progression versus degeneration is probably familiar to most of those present, through the writings of Sir John Lubbock and Mr. E. B. Tylor. To the several weighty arguments in favour of progression given by those writers I will add this one derived from the sequence of ideas.

If the Australians, for example, were the degenerate descendants of people in a higher phase of culture, then, as all existing ideas are made up of previous ideas, we must inevitably find amongst their arts traces of the forms of earlier and higher arts, as is the case amongst some of the savages of South America who early came in contact with Peruvian civilization; but the reverse of this is the case: all the forms of the Australian weapons are derived from those of nature.

In the same way that we saw that the forms of the palaeolithic flint implements were suggested by accidental fractures in the workshop, so the several forms of the Australian wooden implements were suggested by the various forms of the stems and branches out of which they were made. These savages, having only flint tools to work with, cannot saw out their weapons to any form they please; they can only trim the sticks into a serviceable shape. All their weapons are therefore constructed on the grain of the wood, and their forms and uses have arisen from a selection of the natural curves of the sticks.

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[1] Sir W. Wilde, *Catalogue of the Antiquities of the Museum of the Royal Irish Academy* (Dublin, 1863).

I have arranged, on Plate III, drawings of nearly all the weapons used by the Australians, placing them together according to their affinities in such a manner as to show hypothetically their derivation from a single form. As all the forms given on this diagram are drawings of weapons in use at the present time, and there are many intermediate forms not given here, I have not arranged them in horizontal lines, as in the previous diagrams, to show their place in time, but have arranged them as radiating from a central point. We know nothing of the antiquities of savage countries as yet, and therefore cannot trace their evolution in time. The development has therefore been shown by means of survivals of early forms existing at the present time.

In the centre I have placed the simple cylindrical stick, as being the simplest form. By a gradual development of one end I have traced upwards the formation of a sharp ridge and its transition into a kind of mushroom form. To the right upwards I have traced the same development of the mushroom head, the projecting ridge of which is constantly liable to fractures by blows; and as savages always systematize accidental fractures so as to produce symmetry, scollops have been cut out of the ridge in different places for this purpose, which had the effect of concentrating the force of the blow on the projections. These were further developed; one of the pilei of the mushroom head was made larger than the others, and this suggested the form of a bird's head, so that it was only necessary to add a line for the mouth and a couple of eyes to complete the resemblance. To the right we see that the plain stick held in the centre gave the first idea of a defensive weapon, and was used to parry off the darts of the assailant; an aperture was then made in the stick for the hand, and the face of it became broader, developing into a shield, the narrow ends, however, being still retained for parrying.

Below I have shown that the long stick simply pointed at one end became a lance; a row of sharp flints were gummed on to one side to produce a cutting edge, and these were then imitated in wood, and by pointing them obliquely they were converted into barbs. To the right another kind of barb was produced by binding on a piece of sharp-pointed wood. Between this and the shields we see that the first idea of the throwing-stick, employed to project these lances, was simply constructed like the barbed point of the lance itself. The gradual expansion of the stick arose from its being employed like a battledore, to fence off the enemy's lances. To the left below I have shown the gradual development of a peculiar curved weapon, called the 'malga', formed from a stem and the branch projecting from it at different angles. The part where the continuation of the stem was cut off was trimmed to a kind of ridge; this ridge developed, and suggested the crest of a bird's head; ultimately the eyes were added, in the same manner as in the club on the opposite side of the diagram. To the left we see the plain round stick first flattened, then curved. Savages are in the habit of throwing all their weapons at their adversaries and at animals. In throwing a flat curved stick it rotates of its own accord, and as the axis of rotation continues parallel to itself, the thin edge is presented to the resistance of the air in front; this increases the range, and its peculiar flight must have forced itself on the attention of the savage as the result of experience: but he has never had the slightest knowledge of the laws of its flight. The different curves of the boomerang are the natural curves of the sticks, and like all the Australian weapons, they are made on the grain of the wood. Some are thicker than others; some will fly in the curves peculiar to that weapon, and others will not: scarcely two are alike.

To the left above, we see the mushroom-headed 'waddy', with its projecting ridge flattened, then curved; one side becomes more developed than the other, and this being thrown develops into the waddy boomerang, the ridge of the earlier forms being still represented by a mark on the flat head of the weapon; an intermediate link connects it with the true boomerang.

Many other examples might be given to illustrate the continuity which exists in the development of all savage weapons;

but I only ask you to glance at the sequence shown in this diagram and the preceding ones in order to convince you of the truth of the statement which I made at the commencement of this discourse, that although, owing to the complexity of modern contrivances and the larger steps by which we mount the ladder of progress in the material arts, their continuity may be lost sight of, when we come to classify the arts of savages and prehistoric men, the term 'growth' is fully as applicable to them as to the development of the forms of speech, and that there are no grounds, upon the score of continuity, history, or the action of free will, to separate these studies generically as distinct classes of science.

But in dealing with evolution we have to speak not only of growth, but, as in all other natural sciences, of the principle of decay. By decay I do not mean the decay of the materials of the arts, but the decomposition of the mental ideas which produced them.

As complex ideas are built up of simple ones, so there is also a further process by which they become disintegrated, and the parts go to form parts of other ideas.

This decay in the arts corresponds to what is called phonetic decay in language; and in both cases it arises either from incapacity, the desire to save trouble, or the necessity of abbreviating when ideas originally evolved for one purpose come to form parts of other ideas to which they are merely accessory and subordinate, as in the well-known dialectic changes of speech. Every sound in language had originally a distinct meaning of its own; gradually these sounds or roots came to form parts of words in which the original meanings of the sounds were lost.

I will now endeavour to draw a parallel to this in the arts, by means of what may be termed realistic degeneration.

I will not say much as to the place of realism in culture. The archaeological world has lately been somewhat startled by the discovery of well-executed designs of elephants and other animals in the French caves in association with the rude stone implements of the palaeolithic age, and by the more recent discovery of Mariette Bey, that the earliest Egyptian sculptures of the third dynasty are the most truthful representations of the human form that are to be found in that country. I see nothing surprising in this, when we consider the power that is developed in many children of eight or nine years old of making drawings of animals and other objects, which, when allowance is made for the feeble hand of childhood, are often as truthful as those of the cave-period men, at a time when their minds have acquired but little power of reasoning or generalizing, or even of taking care of themselves; all which goes to prove that this power of imitation, which is a very different thing from ideal art, is one of the most early developed faculties of the mind of man.

When the power of imitation had once been developed, it would naturally be made use of as a means of intercommunication; thus the drawing of a stag would be made to convey information to people at a distance that there was a herd of deer in the neighbourhood to be hunted; and as the object of the drawing was no longer to depict truthfully the peculiarities of the beast, but merely to convey information, the amount of labour expended upon it would be the least that could be employed for the required purpose. All written characters have originated in this way; and no one now requires to be told how pictographic representations developed into hieroglyphic and subsequently into phonetic characters.

But realistic degeneration would equally take place in all cases in which pictorial representations came to be employed for other purposes than those for which they were originally designed, as in the case of ornamental designs.

So also a coin receives upon its surface the image of a king or a god as a stamp of authority. When from any cause the object of the original design is lost, the object of the stamp being no longer to convey a likeness, but being merely used as a test of genuineness, or perhaps amongst an unlettered people to denote its value, the tendency to realistic degeneration would be proportioned to the difficulties of execution; no further labour would be expended on it than was necessary for the object to be attained. Here I must again remind you of the interesting discourse delivered in this Institution on May 14, 1875, by Mr. Evans, on the evolution of British coins.[1] His examples are figured in his *Coins of the Ancient Britons*, pp. 24–32. With his permission I have introduced some of his diagrams (Plate XXI). You will remember how the coin of Philip of Macedon having been introduced into Britain, the head on the obverse gradually disappeared, leaving only the wreath as a band across the coin, which was ultimately converted into a cross; and how on the reverse, the chariot and two horses dwindled into a single horse, the chariot disappeared, leaving only the wheels, the driver became elevated, not elevated after the manner unfortunately but too common amongst London drivers, but elevated after the manner of the Spiritualists, except that you see he had the precaution to take on a pair of wings, differing also both from the London driver and the Spiritualists, inasmuch as instead of having lost his head he has lost his body, and nothing but the head remains; the body of the horse then gradually disappears, leaving only four lines to denote the legs.

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[1] John Evans, 'On the Coinage of the Ancient Britons and Natural Selection,' *Journal of the Royal Institution*, vii. p. 476 ff.; with a Plate, which is reproduced, by permission, in Plate XXI.

I will now show you an exact parallel to these transformations in a collection of designs, supposed to be tribal marks, which are drawn upon the paddle blades of the New Irelanders, a race of Papuan savages inhabiting an island on the north-east coast of New Guinea.

Having noticed one or two allied varieties of design in specimens that came into my possession, I determined to collect all that I could find as they came to this country. In the course of several years I succeeded in obtaining the series represented upon Plate IV.

The first figure you will see clearly represents the head of a Papuan: the hair or wig is stuffed out, and the ears elongated by means of an ear ornament, after the manner of these people; the eyes are represented by two black dots, and the red line of the nose spreads over the forehead. This is the most realistic figure of the series. In the second figure the face is somewhat conventionalized: the line of the nose passes in a coil round the eyes; there is a lozenge pattern on the forehead, representing probably a tattoo mark; the body is represented sitting in full. In the third figure the man is represented sitting sideways, simply by lopping off an arm and a leg on one side. In the fourth figure the legs have disappeared. In the fifth figure the whole body has disappeared. In the sixth figure the nose has expanded at the base, and the sides of the face are made to conform to the line of the nose; the elongated ears are there, but the ear ornament is gone: the nose in this figure is becoming the principal feature. In the seventh figure nothing but the nose is left: the sides of the face and mouth are gone; the ears are drawn along the side of the nose; the head is gone, but the lozenge pattern on the forehead still remains; the coil round the eyes has also disappeared, and is replaced by a kind of leaf form, suggested by the upper lobe of the ear in the previous figures; the eyes are brought down into the nose. In the eighth figure the ears are drawn at right angles to the nose. In the ninth figure the nose has expanded at the base; all the rest is the same as in the last figure. In the tenth figure the lozenge pattern and the ears have disappeared, and a vestige of them only remains, in the form of five points; the base of the nose is still further expanded into a half moon. In the last figure, nothing but a half moon remains. No one who compared this figure with the first of the series, without the explanation afforded by the intermediate links, would believe that it represented the nose of a human face. Unfortunately we do not know as yet the exact meaning of these designs, but when further information is obtained about them it will throw considerable light on similar transformations in prehistoric times.

My next and last illustration is taken from the relics of Troy, recently brought to light by Dr. Schliemann.[1] In the valuable work lately published by him he gives illustrations of a number of earthenware vases and other objects, called by him idols, having on them the representation of what he conceives to be the face of an owl, and which he believes to represent Athena, the tutelary goddess of Troy, called by Homer 'Glaukopis Athene', which signifies, according to him, 'with the face of an owl.' Professor Max Müller has given his opinion that the word 'glaukopis' cannot possibly be taken to mean owl-faced, but can only mean large- or bright-eyed. On this point I will venture no opinion, but accepting Professor Müller's high authority for the usually received interpretation of it being correct, I shall in no way weaken the evidence in favour of Dr. Schliemann's discovery of the true site of Troy if I succeed in proving that, according to the true principle of realistic degeneration, this figure does not represent an owl but a human face.

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[1] For illustrations, see *Troy and its Remains*, by Dr. Henry Schliemann (Murray, 1875). The figures may be taken in the following order: No. 185, No. 74, No. 132, No. 13, No. 173, No. 207, No. 12, No. 11, No. 133, No. 141, No. 165. [Plate V has been compiled from the references here given.]

The figures on Plate V are all taken from Dr. Schliemann's representations, and as the depth of each is given it will be seen that the different varieties of face occur in all the different strata excavated by him except the highest, and therefore no argument as to antiquity can be based upon the depth at which they were found. The two first figures, it will be seen, are clearly intended to represent a human face, all the features being preserved. In the two next figures (3, 4) the mouth has disappeared, but the fact of the principal feature being still a nose and not a beak, is shown by the breadth of the base and also by the representation of the breasts. In the two succeeding figures (5, 6) the nose is narrowed at the base, which gives it the appearance of a beak, but the fact of its being still a human form is still shown by the breasts. Had the idea of an owl been developed through realistic degeneration in these last figures, it would have retained this form, but in the two succeeding figures (7, 8) it will be seen that the nose goes on diminishing.

In the remaining figures, some of which are (12–16) of solid stone, not earthenware, and are believed by Dr. Schliemann to be gods, it is clearly shown by the rude scratches representing the eyebrows, and their want of symmetry, that this degeneration of form is the result of haste.

What then are these solid stone objects? I cannot for a moment doubt, from their resemblance to the vases, from the marks denoting the junction of the cover with the vase, and from the representations of handles, that they are votive urns of some kind, similar to those Egyptian stone models of urns represented in the two figures above. Urns of this kind were used by the Egyptians to contain the viscera of the mummies; but with the cheaper form of burial, in which the viscera were retained in the body, stone models of urns, of which these figures are drawings from originals in the British Museum, were deposited in the graves as vestiges of the earlier and more expensive process; these objects therefore cannot be idols, but votive urns. The fact of human remains having been found in some of the human-headed urns, and the hasty scratches on the stone models, show that they are merely models appertaining to the conventionalized survival of some earlier or more elaborate system of urn burial.

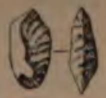
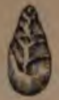
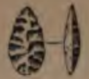
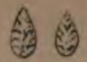
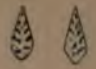
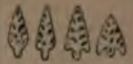
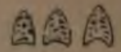
We see from these facts that both growth and decay, the two component elements of evolution, are represented in the study of the material arts.

My object in this discourse has been not, as I fear it may have appeared to you from the brief time at my disposal and my imperfect treatment of the subject, to extol the material arts as being intrinsically of more interest or importance than other branches of culture, but to affirm the principle that it is by studying the psychology of the material arts alone that we can trace human culture to its germs.

The theory of degradation is supported only by the study of those branches of culture of which the early history is lost.

The tree is the type of all evolution: all trees are seedlings, but they differ in their mode of growth. Some, like the beech and oak, throw their branches upwards, and these are typical of the development of the material arts; others, like the straight-stemmed pine, throw off their branches downwards, and these are typical of the development of some other branches of culture. It is quite true, as stated by mythologists, that the history of myths is one of continued degeneration in so far as they can be traced, and that the element of decay enters far more into their composition than that of growth. But the whole accessible history of these myths represents drooping branches from the upward-growing stem of free thought out of which they sprang. What is the space of time which separates us from the Vedas, as compared with the whole upward growth of humanity before and since!

There are huge gaps in our knowledge of the history of the human race, and it has been the pleasure of mankind in all ages to people these gaps with jugglers and bogies; but surely, if slowly, science will open up these desert places, and prove to us that, so far as the finite mind of man can reach, there is nothing but unbroken continuity to be seen in the present and in the past.

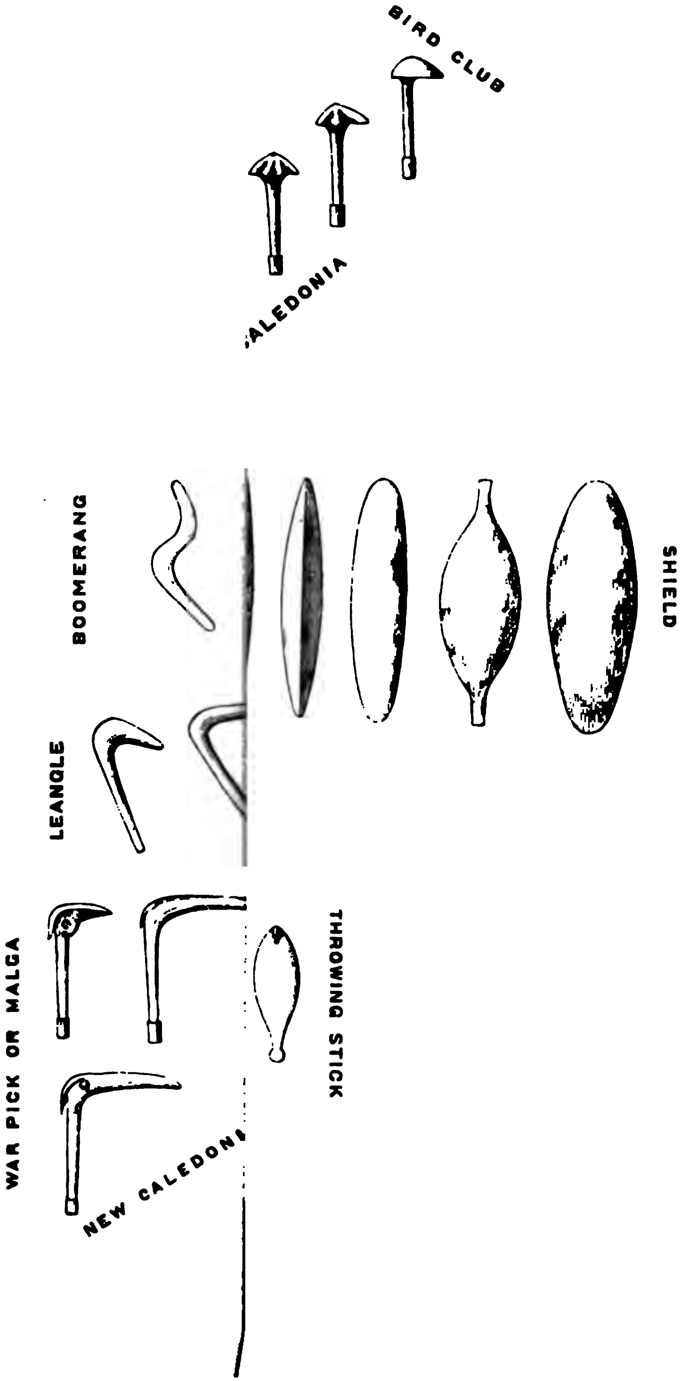
	SIDE TOOL 	TONGUE SHAPED 	OVAL 	LEAF SHAPED 	LOZENGE SHAPED 	BARBED 	TRIANGULAR 	
EARLY PALÆOLITHIC	✚	✚	✚					
LATE PALÆOLITHIC	▮	▮	▮	✚	✚			
EARLY NEOLITHIC				✚	✚			
LATE NEOLITHIC				✚	✚	✚	▮	
EARLY BRONZE				✚	✚	✚	✚	
LATE BRONZE				✚	✚	✚	✚	
IRON PERIOD								
MODERN AUSTRALIAN				▮				
MODERN AMERICAN				✚	✚	✚	✚	

✚ ---- DENOTES COMMON OCCURRENCE ▮ ---- DENOTES RARE OR DOUBTFUL

	FLINT.				BRONZE.						
	SIDETOOL	TONGUE SHAPED	OVAL.	CELT	CONVEX & FLAT SURFACES	STOP	FLANGE	STOP & FLANGE	OVERLAPPING FLANGE	BRONZE SOCKET	IRON SOCKET
EARLY PALÆOLITHIC	✚	✚	✚								
LATE PALÆOLITHIC	▮		▮	▮							
EARLY NEOLITHIC				✚							
LATE NEOLITHIC				✚							
EARLY BRONZE				▮	✚						
LATE BRONZE					✚	✚	✚	✚	✚	✚	
IRON PERIOD											✚
AUSTRALIAN			▮	✚							
AMERICAN				✚	✚		✚				

✚ DENOTES COMMON OCCURRENCE ▮ RARE OR DOUBTFUL

PLATE III.


BIRD CLUB
ALEDONIA
BOOMERANG
LEANGLE
SHIELD
WAR PICK OR MALGA
THROWING STICK
NEW CALEDONI

[*P. R. I. G. B.*, VII. Pl. iv = *J. A. I.*, IV. Pl. xxii.] PLATE IV.

Fig. 1.

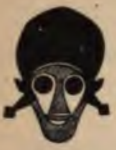


Fig. 2.

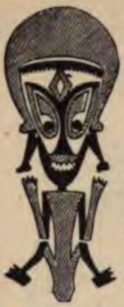


Fig. 3.

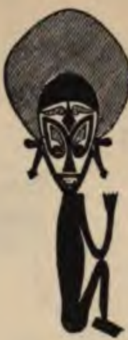


Fig. 4.

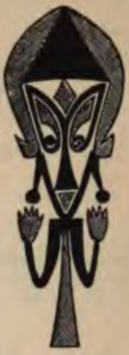


Fig. 5.

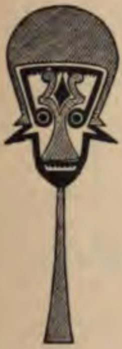


Fig. 6.

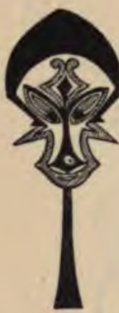


Fig. 7.

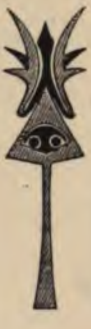


Fig. 8.

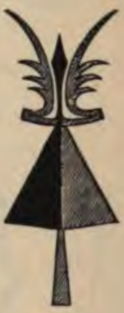


Fig. 9.

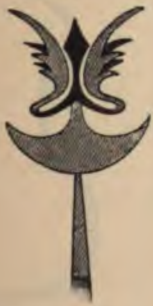


Fig. 10.

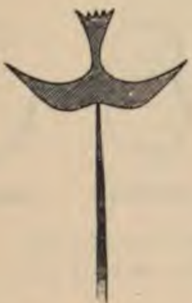
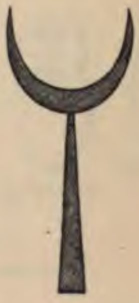
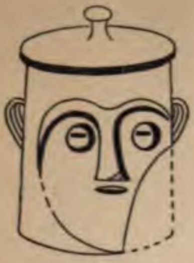


Fig. 11.



ORNAMENTATION OF NEW IRELAND PADDLES, SHOWING THE TRANSITION OF FORM.

PLATE V.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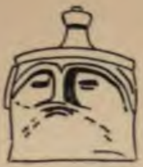
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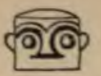
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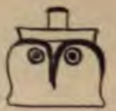
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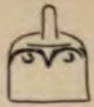
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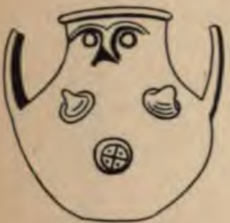
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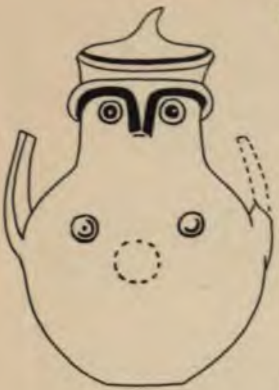
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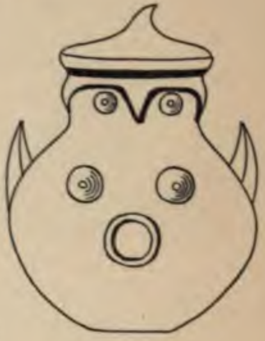
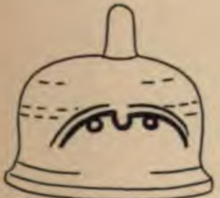
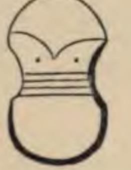

6 (207: 6m)


9 (133: 3m)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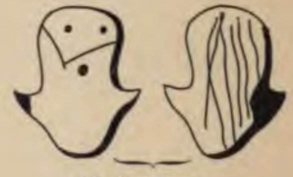
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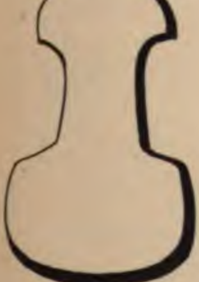
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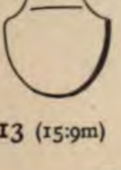
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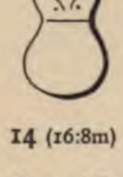
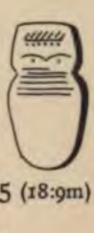
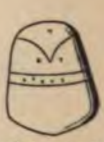

14 (16:8m)


15 (18:9m)


16 (20:8m)

Nos. 1–11 are of Terra-cotta.

Nos. 12–16 are of White Marble.

REALISTIC DEGENERATION.

ILLUSTRATED BY REPRESENTATIONS OF THE HUMAN FACE, FOUND BY DR. SCHLIEMANN AT TROY.

[*The numerals in brackets give*—(1) *the number of the figure in Schliemann's* Troy and its *Remains*, (2) *the depth at which the figure was found, in metres.*]

[*Proc. R*

PRIMITIVE WARFARE[1]

I

ALTHOUGH it is more in accordance with the purposes for which this establishment has been organized, that the Lecture-room should be devoted chiefly to subjects of practical utility connected with the improvement of our military system and the progress of the mechanical appliances, the organization, and general efficiency of our Army and Navy, than to the efforts of abstract science, yet the fact of your possessing in the three large apartments that are devoted to your armoury, one of the best assortments of semi-civilized and savage weapons that are to be found in this country, or, perhaps, in any part of the world, is sufficient to prove that it is not foreign to the objects of the Institution that the science of war should be ethnographically and archaeologically, as well as practically, treated.

The requirements of our advancing age demand that every vein of knowledge should be opened out, and, in order to make good our title to so interesting a collection of objects as that comprised in what may very properly be called our ethnographical military department, it should be shown that, whether or not the subject may be considered to fall within the ordinary functions of the Society, our Museum is made available for the purposes of science.

The age in which we live is not more remarkable for its rapid onward movement than for its intelligent retrospect of the past. It is reconstructive as well as progressive. The light which is kindled by the practical discoveries of modern science, throws back its rays, and enables us to distinguish objects of interest, which have been unnoticed in the gloom of bygone ages, or passed over with contempt.

Men observe only those things which their occupations or their education enable them to understand and appreciate. When a savage is introduced on board the deck of a European vessel, he notices only those objects with the uses of which he is familiar —the sewing of a coat, a chain, or a cable, at once rivets his attention, but he passes by the steam-engine without observation, and if a work of art is forced upon his notice, he is unable to say whether it represents a man, a ship, or a kangaroo![1] So in past ages the flint implements of the drift, the parents of all our modern implements, whether for war or handicraft, must have been carted away in hundreds, unobserved, and in ignorance that these inconspicuous objects would one day be the means of upsetting the received chronology of our species.

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[1] A Lecture delivered at the Royal United Service Institution, Friday, June 28, 1867; illustrated by specimens from the Museum of the Institution: and published in the *Journal of the R. U. S. Inst.* xi (1867).

Whilst, therefore, we devote our energies chiefly to progress, and fix our attention upon the present and future of war, it cannot fail to interest those who are actively engaged in the duties of their profession, if we occasionally take a glance backward and see what recent discoveries have done towards elucidating its origin and early history.

It might, perhaps, assist a right understanding of the principles on which the weapons and implements of savages deserve to be studied, if I were to notice some of those great questions respecting the origin of our species, and man's place in nature, which the investigations of science have been the means of raising in our day. I need hardly say that the rude implements, which I I am about to describe, are of little practical interest in themselves, as models for instruction or imitation. We have no need of bows and arrows in the existing state of war, and if we did require them, the appliances of modern times would enable us to construct them in far greater perfection than could be acquired by any lessons from savages. These weapons are valuable only, in the absence of other evidence, from the light they throw on prehistoric times, and on those great questions to which I have alluded, and from their enabling us to trace out the origin of many of those customs which have been handed down to us by past generations.

As, however, the discussion of these interesting subjects would lead me into matters that are hardly suited to the Lecture-room of this Institution, I must pass over the consideration of them with a few brief remarks.

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[1] Beechey, *Voyage to the Pacific* (London, 1831), vol. i. p. 298; Oldfield, 'Aborigines of Australia,' *Trans. Ethno. Soc.*, N. S. (London, 1865), vol. iii. p. 227.

In so doing, I may appear to postulate some opinions upon points that are still the subject of animated controversy in the scientific world. But it would require a far broader field of investigation than is here afforded me, in order to treat these inquiries successfully, and to adduce all the evidence that would be necessary to support the hypotheses put forward; and I am anxious to devote no greater space to these preliminary remarks than is necessary to point out some of the main features of interest that are involved in the particular study which forms the subject of my lecture.

We are apt to speak of the creation of the universe as a thing of the past, and to suppose that the world, with all the varied life upon it, previous to man's appearance, having been created for his especial happiness and supremacy, was afterwards left to his control and government. But this view of the subject belongs to an age in which the laws of nature in their all-sufficiency and completeness were but little studied and appreciated. Modern science finds no evidence of any such abandonment of the universe to man's jurisdiction. The more comprehensively the subject is viewed, the more restricted appear to be those limits over which the free will of mankind is permitted to range, and the more evident it becomes, that in his social advancement, his laws, arts, and wars, he moves on under the influence and development of those same laws which have been in force from the very first dawn of creation. The lower the archaeologist searches in the crust of the earth for the relics of human art, the more faint become the traces of that broad gulf, which in our times appears to separate man from the brute creation. In all the numerous and varied offsprings of the human intellect, in the arts, and even in speech, the more we investigate and trace them back, the more clearly they appear to point to a condition of the human race in which they had no existence whatever. The great law of nature, 'natura non facit saltum,' was not broken by the introduction of man upon the earth. He appears to have been produced in the fullness of time, as the work of creation required a more perfect tool, and to have ameliorated his condition, only as the work to be performed became more complicated and varied, just as in the hands of man, the rougher tool is employed for felling, and the finer tool for finishing and polishing.

By this view we come to look upon even the most barbarous state of man's existence, as a condition, not so much of degradation, as of arrested or retarded progress, and to see that, notwithstanding many halts and relapses, and a very varied rate of movement in the different races, the march of the human intellect has been always onward.

As, in the lower creation, we find no individuals that are capable of self-improvement, though some appear, by their imitative faculties, to contain within them the germs of an improving element, so the aboriginal man, closely resembling the brutes, may have passed through many generations before he began to show even the first symptoms of mental cultivation, or the rudiments of the simplest arts; and even then his progress may have been, at first, so slow, that it is not without an effort of imagination that the civilized races of our day can realize, by means of the implements which he has left us, the minute gradations which appear to mark the stages of his advancement. This appears to be the view taken by Sir Charles Lyell in his *Antiquity of Man*, when, in comparing the flint implements found in the higher and lower-level gravels of the valley of the Somme, he arrives at the conclusion 'that the state of the arts in those early times remained stationary for almost indefinite periods'. 'We see,' he says, 'in our own time, that the rate of progress in the arts and sciences proceeds in a geometrical ratio as knowledge increases, and so, when we carry back our retrospect into the past, we must be prepared to find the signs of retardation augmenting in a like geometrical ratio; so that the progress of a thousand years at a remote period, may correspond to that of a century in modern times, and in ages still more remote man would more and more resemble the brutes in that attribute which causes one generation exactly to imitate, in all its ways, the generation which preceded it' (4th ed. 1873, p. 421).

In order to understand the relationship which the savage tribes of our own time bear to the races of antiquity, it is necessary to keep in view that, neither in historic nor prehistoric times is there any evidence that civilization has been equally or universally distributed; on the contrary, it appears always to have been partial, and confined to particular races, whose function it has been, by means of war and conquest, to spread the arts amongst surrounding nations, or to exterminate those whose low state of mental culture rendered them incapable of receiving it.

Assuming the whole of the human species to have sprung originally from one stock, an hypothesis which, although disputed, appears to me by all existing evidence and analogy of known facts, to be the most reasonable assumption, the several races appear to have branched off at various and remote periods, many of them, perhaps, previously to the present geographical arrangement of land and water, and to have located themselves in the several regions in which they are now found, in a state which probably differs but little from that in which they existed at the time of their separation from the parent stem.

Each race, after separation, shows evidence of arrested growth; and, finally, the intellect of the nation fossilizes and becomes stationary for an indefinite period, or until destroyed by being brought again in contact with the leading races in an advanced stage of civilization, precisely in the same way that the individuals composing these races, after propagating their species, stagnate, and ultimately decay, or, in a low state of savagery, are often destroyed by their own offspring.

Taking a comprehensive view of the development of civilization, it may be compared to the growth of those plants whose vigour displays itself chiefly in the propagation of their leading shoots, which, overtopping the older and feebler branches, cause them to be everywhere replaced by a fresh growth of verdure. The vegetable kingdom thus furnishes us with the grand type of progress; continuity and bifurcation are principles of universal application, uniting the lowest with the highest created thing.

The analogy of tree growth has been frequently employed in relation to natural phenomena, and it may very well be taken to explain the distribution of the human race, and the progress and expansion of the arts. It forms the key to the Darwinian theory of natural selection, which is essentially monogenistic in its application to the origin of the human race.

Thus the existing races of mankind may be taken to represent the budding twigs and foliage, each in accordance with the relative superiority of its civilization, appertaining to branches higher and higher placed, upon the great stem of life.

So little is as yet known of the early history of any but our own family of nations, that in the existing state of knowledge, the attempt to classify and place them on their proper branches, must be attended with much difficulty, and great liability to error. However, by arranging the existing races according to their civilization, a tolerably correct judgement may perhaps be formed as to the value of this system of classification, if we distribute them with those of antiquity in some two or three broad divisions. The Caucasian races of modern Europe, for example, may be said to bear to their ancestors of the historical period the same relationship that geologists have shown the existing mammalia of our forests to bear to the mammalia of the tertiary geological period. The semi-civilized Chinese and Hindoos, in like manner, may be classed with the races of ancient Assyria, Egypt, and other nations immediately prior to the first dawn of history, the civilization of which nations they still so greatly resemble, and appear to have retained, in a state of retarded progress from those ages to our own. A third division may perhaps be made of the Malay, Tartar, and African negro nations, which, though now in an age of iron, may, by the state of their arts, and more especially by the form of their implements, be taken as the best representatives of the prehistoric bronze period of Europe, towards which they appear to hold the same relationship that the fish and reptiles of our seas bear to those of the secondary geological period. In a fourth division may be included the still more barbarous races of our times, the Australian, Bushman, and hunting races of America, whose analogy to those of the stone age of Europe may be typified by that of the mollusca of recent species to the mollusca of the primary geological period.

In all these existing races, we find that the slowness of their progression and incapacity for improvement is proportioned to the low state of their civilization, thereby leading to the supposition that they may have retained their arts with but slight modification from the time of their branching from the parent stem, and may thus be taken as the living representatives of our common ancestors in the various successive stages of their advancement.

Many examples of this immobility on the part of savages and semi-civilized races may be given.

Throughout the entire continent of Australia the weapons and implements are alike, and of the simplest form, and the people are of the lowest grade. The spear, the waddy, and the boomerang, with some stone hatchets, are their only weapons; but amongst these it has been noticed that, like the implements of the drift, there are minute differences, scarcely apparent to Europeans, but which enable a native to determine at a glance to what tribe a weapon belongs.[1] This, whilst it proves a tendency to vary their forms, shows at the same time either an incapacity, or, what answers the same purpose, a retarding power or prejudice, which prevents their effecting more than the smallest appreciable degree of change. In the island of Tahiti, Captain Cook was unable to make the natives (a superior race to the Australians) appreciate the uses of metal, until he had caused his armourer to construct an iron adze (Plate VI, fig. 1 *a*)[2] of precisely the same form as their own adzes of basalt (Fig. 1 *b*). After that, metal tools came into general use amongst them, though their old forms are in a great measure preserved to this day. When, during the American War, the English endeavoured to utilize the Indians by arming them, they were compelled to construct for them tomahawks after their own pattern, having a pipe in the handle (Fig. 2). When the Purus Indians of South America receive a knife from Europeans they break off the handle, and fashion the knife according to their own ideas, placing the blade between two pieces of wood, and binding it round tight with a sinew.[3] The natives of Samoa now use iron adzes, constructed after the exact pattern of their ancient stone ones.[4] The Fiji Islanders, though they have now the means of obtaining good blades and chisels from Sheffield, and axes from America, prefer plane irons to any other form of implement, because they are able to fix them by lashing them on to their handles in the same fashion as the ancient stone adzes of their own manufacture, which they resemble. The Andaman Islanders use the European metal that falls into their hands, only to grind it down into spear- and arrow-heads of the same form as their stone ones. The same applies to the whole of the Aborigines of North and South America, which have stood by, for nearly three centuries, passive spectators of the arts of Europeans, without attempting to copy them. Crawfurd, in his *History of the Indian Archipelago*,[1] comments on the obstinate adherence of the Javanese to ancient customs, in accounting for the kris having been retained by them long after the causes which produced that peculiar weapon had ceased to operate. Tylor, in his account of the Anahuac, observes upon the preservation of old types amongst the present inhabitants of Mexico, which have remained almost unchanged from generation to generation, enabling the historian to distinguish clearly those which are of Aztec from those which are of Spanish origin.[2] Herodotus describes the spears carried by the Ethiopians in the army of Xerxes as being armed with the sharpened horn of the antelope.[3] Consul Petherick found still in use by the Djibba negroes, more than two thousand years after, these identical spears, armed with the straightened and sharpened horn of the antelope, and their other weapons also resembled in character those described by Herodotus, although they had passed from the stone weapons then used, into an age of metal.[4] The Scythian bow (Plate VI, fig. 3) is the bow still used by the whole of the Tartar races (Fig. 4). The celt of the Tartar, and the celt and sword of the Negro (Fig. 5) are still the celt and sword of the European bronze period (Fig. 6), and this resemblance is not confined to the general outline of the weapons, but extends to the style and patterns of ornamentation. The same identity of form exists between the 'manillas' (Fig. 7) used as a medium of exchange in the Eboe country of West Africa and the so-called penannular rings or ring money (Fig. 8) of gold and bronze which are found in Ireland, and which, with some modifications, belong also to Germany and the Swiss Lakes. The corrugated iron blade of the Kaffir assegai, a section of which is shown in Fig. 9, and which is used also in Central and West Africa, is identical with those found in the Saxon graves (Fig. 10), and is intended to give a spiral motion to these missiles. Chevalier Folard observes that the Gauls were remarkable for the tenacity with which they clung to their ancient customs, while the Romans, their conquerors, are mentioned by all historians as peculiar in their time for the facility with which they adopted the customs of others, and developed their own.[1] In modern Europe, the Gipsies have also been noticed as being distinguished from the Europeans in all the various localities in which they are found, for their remarkable adherence to especial arts, savouring of an extinct civilization. Amongst the Chinese and Hindoos, the conservatism which has caused them to remain for ages in nearly the same condition is too well known to require comment. It will, however, be remembered (in illustration of the fact that customs of minor importance often survive great political changes, and serve to keep up the continuity that would otherwise be broken), that after the Manchu Tartars had conquered and established themselves in the Chinese territory, they were nearly driven again from the country, on account of their forcing upon the subject people the custom of wearing pigtails, after the fashion of their conquerors; showing how difficult it is to ingraft, upon an alien race, customs that are not indigenous.

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[1] Oldfield, 'On the Aborigines of Australia,' *Trans. Ethno. Soc.*, N.S., vol. iii. pp. 261–7.

[2] Meyrick (Skelton), *Engraved Illustrations of Ancient Arms*, &c. (1830), vol. ii. pl. cxlix. 11.

[3] Klemm, *Werkzeuge und Waffen* (Sondershausen, 1858), p. 159.

[4] Turner, *Nineteen Years in Polynesia* (London, 1861), p. 262.

[5] Williams, *Fiji and the Fijians* (London, 1858), vol. i. pp. 78–9.

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[1] Crawfurd, *History* (Edinburgh, 1820), vol. i. p. 224.

[2] Tylor, *Anahuac* (London, 1861), p. 70.

[3] Hdt. vii. 69: Rawlinson, *Herodotus*, vol. iv (2nd ed., 1862, p. 55).

[4] Petherick, *Egypt, the Soudan, and Central Africa* (Edinb. and London, 1861), p. 360.

These, and many other notices of a similar character that are to be found in the pages of travel, establish it as a maxim, that the existing races, in their respective stages of progression, may be taken as the bona fide representatives of the races of antiquity; and, marvellous as it may appear to us in these days of rapid progress, their habits and arts, even to the form of their rudest weapons, have continued in many cases, with but slight modifications, unchanged throughout countless ages, and from periods long prior to the commencement of history. They thus afford us living illustrations of the social customs, the forms of government, laws, and warlike practices, which belonged to the ancient races from which they remotely sprang, whose implements, resembling, with but little difference, their own, are now found low down in the soil, in situations, and under circumstances in which, alone, they would convey but little evidence to the antiquary, but which, when the investigations of the antiquary are interpreted by those of the ethnologist, are teeming with interesting revelations respecting the past history of our race; and which, in the hands of the anthropologist, in whose science that of antiquity and ethnology are combined with physiology and geology, are no doubt destined to throw a flood of light, if not eventually, in a great measure, to clear up the mystery, which now hangs over everything connected with the origin of mankind.

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[1] Le Sieur de Folard, *Nouvelles Découvertes sur la Guerre* (Paris, 1724), p. 48.

That such a combination of the sciences should have been brought about so opportunely in our days, appears to me to be one of those many indications of an overruling power directing in the aggregate the minds of men, which must, at all times, strike even the most superficial observer of nature; for there can be little doubt that in a few years all the most barbarous races will have disappeared from the earth, or will have ceased to preserve their native arts.

The law which consigns to destruction all savage races when brought in contact with a civilization much higher than their own, is now operating with unrelenting fury in every part of the world. Of the aborigines of Tasmania, not a single individual remains; those of New Zealand are fast disappearing. The Australian savage dies out before the advancing European. North and South America, and the Polynesian Islands, all tell the same tale. Wherever the generous influences of Christianity have set foot, there they have been accompanied by the scourge. Innumerable and often unseen causes combine in effecting the same purpose; diseases which are but little felt by Europeans, act as plagues when introduced into uncivilized communities, and cause them to fall before their ravages, like wheat before the sickle; and the vices of civilization, taking a firmer hold of the savages than its virtues, aid and abet in the same work. The labours of the missionary, if they have produced no other benefit, have been useful in teaching us the great truth, that notwithstanding the philanthropic efforts of the intruding race, the law of nature must be vindicated. The savage is morally and mentally an unfit instrument for the spread of civilization, except when, like the higher mammalia, he is reduced to a state of slavery; his occupation is gone, and his place is required for an improved race. Allowing for the rapidly increasing ratio in which progress advances, it is not too much to assume, that in half a century from the present time, savage life will have ceased to have a single true representative on the face of the globe, and the evidence which it has been the means of handing down to our generation will have perished with it.

When we find that the condition of the aboriginal man must have been one of such complete inanity as to render him incapable of spontaneously initiating even the most rudimentary arts, it follows as a matter of course that in the earliest stages of his career, he must, like children of our own day, have been subject to compulsory instruction. And in looking to nature for the sources from which such early instruction must have been derived, we need not, I think, be long in coming to the conclusion, that the school of our first parent must be sought for in his struggles for mastery with the brute creation, and that, consequently, his first lessons must have been directed to attaining proficiency in the art of war.

Hence it follows that it is to the lower animals that we must look for the origin of all those branches of primitive warfare which it is the object of this lecture to trace out. Nor indeed shall we fail to find abundant evidence that there is hardly a single branch of human industry which may not reasonably be attributed to the same source.

The province of war extends downward through the animal kingdom, showing unmistakable evidence of its existence in forms, offensive and defensive, differing but little from those of the human era, through the unnumbered ages of the geological periods, long prior to man's advent; proving, beyond the possibility of doubt, that from the remotest age in which we find evidence of organized beings, war has been ordained to an important function in the creative process.

Judging by results, which I apprehend is the only true method of investigating the phenomena of life, three primary instincts appear to have been implanted in nearly all the higher animals[1]:

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[1] In adopting the nomenclature of phrenology, I am not to be understood as advocating strictly the localization of the faculties which phrenology prescribes. The mind doubtless consists of a congeries of faculties, and phrenology affords the best classification of them that has yet been devised.

alimentiveness, for the sustenance of life; amativeness, for the propagation of species; and combativeness, for the protection of species, and the propagation by natural selection of the most energetic breeds; on which latter subject much important information has been given to the world by Mr. Darwin, in his celebrated work on the origin of species.

Much might, I believe, be said on the connexion which subsists between these functions, all of which are, in some form or other, necessary to a healthy condition. Suffice, however, to observe, that as regards the dawn of an Utopia, in which some men who think themselves practical appear to indulge; whether we study the subject by observing the uses to which animals apply the various and ingeniously constructed weapons with which Providence has armed them, or whether we view it in relation to the prodigious armaments of all the most civilized nations of Europe, we find no more evidence in nature, of a state of society in which wars shall cease, than we do of a state of existence in which we shall support life without food, or propagate our species by other means than those which nature has appointed.

The universality of the warlike element is shown in the fact, that the classifications of the weapons of men and animals are identical, and may be treated under the same heads.

Many constructive arts are brought to greater perfection in animals by the development of faculties, especially adapting them to the peculiar implements with which nature has furnished them, than can be attained by man, and especially by the aboriginal man, whose particular attribute appears, by all analogy of savage life, to have been an increase of that imitative faculty which, in the lower creation, is found only in a modified degree in apes.

The lower creation would thus furnish man not only with the first element of instruction, but with examples for the improvement of the work commenced, or, to use the words of Pope:—

From the creatures thy instructions take,
Thy arts of building from the bee receive;
Learn from the mole to plough, the worm to weave;
Learn from the little nautilus to sail,
Spread the thin oars, and catch the driving gale;
Here, too, all forms of social reason find,
And hence let reason late instruct mankind.[1]

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[1] Pope, *Essay on Man*, Epistle iii. 172–80

In the art of war, as we shall see, he would not only derive his first instruction from the beasts, but he would improve his means of offence and defence from time to time by lessons derived from the same source.

It therefore appears desirable that, before entering upon that branch of the subject which relates to the *progress* and *development* of the art of war, I should point out briefly the analogies which exist between the weapons, tactics, and stratagems of savages and those of the lower creation, and show to what extent man appears to have availed himself of the weapons of animals for his own defence.

In so doing the subject may be classified as follows :—

Classification of the Weapons of Animals and Savages.

Defensive.	Offensive.	Stratagems.
Hides.	Piercing.	Flight.
Solid plates.	Striking.	Concealment.
Jointed plates.	Serrated.	Tactics.
Scales.	Poisoned.	Columns.
	Missiles.	Leaders.
		Outposts.
		Artificial defences.
		War cries.

Firstly, with respect to the combative principle itself. The identity of this instinct in men and animals may be seen in the widely-spread custom of baiting animals against each other, a practice which is not derived from any one source, but is indigenous in the countries in which it prevails, and arises from the inherent sympathy which exists between men and animals in the exercise of this particular function.

In the island of Tahiti, long before the first European vessel was seen off their shores, the inhabitants were accustomed to train and fight cocks, which were fed with great care, and kept upon finely-carved perches.[1] Cock-fighting also prevails amongst the Malays, Celebes, and Balinese. The Javanese fight their cocks like the Mahommedans of Hindustan, without spurs; the Malays, Bugis, and Macassars with artificial spurs shaped like a scythe.[1] It also prevails in Central Africa, Central America, and Peru. The Sumatrans fight their cocks for vast sums; a man has been known to stake his wife and children, son, mother, or sister on the issue of a battle, and when a dispute occurs, the owners decide the question by an appeal to the sword. In like manner Adrastus, the son of Midas, King of Phrygia, is said to have killed his brother in consequence of a quarrel which took place between them in regard to a battle of quails.

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[1] Ellis, *Polynesian Researches* (London, 1829), vol. i. pp. 302–3.

When Themistocles led the Greeks out against the Persians, happening to see two cocks fight, he showed them as an example to his soldiers. Cock-fighting was afterwards exhibited annually in presence of the whole people, and the crowing of a cock was ever after regarded as a presage of victory.[2]

The Javanese also fight hogs and rams together. The buffalo and tiger are matched against each other. In Butan the combat is between two bulls. Combats of elephants took place for the amusement of the early Indian kings. The Chinese and Javanese fight quails, crickets, and fish. The Romans fought cocks, quails, and partridges, also the rhinoceros. In Stamboul two rams are employed for fighting. The Russians fight geese, and the betting runs very high upon them.[3] We find horses, elephants, and oxen standing side by side with man in hostile array, and dogs were used by the Gauls for the same purpose. Amongst the ancients, the horse, the wolf, and the cock were offered on the altar of Mars for their warlike qualities.

Who can doubt with these examples before us, that an instinct so widely disseminated and so identical in men and animals, must have been ordained for special objects?

The causes which give rise to the exercise of the function, vary with the advance of civilization. We have now ceased to take delight in the mere exhibition of brute combats, but the profession of war is still held in as much esteem as at any previous period in the history of mankind, and we bestow the highest honours of the State upon successful combatants.

This, however, leads to another subject, viz. the causes of war amongst primitive races, which is deserving of separate treatment.

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[1] Crawfurd, *History of the Indian Archipelago* (1820), vol. i. pp. 113–4.

[2] Beckman, *History of Inventions* (London, 1814), pp. 503–4.—Cock-fighting.

[3] Stanley, *History of Birds* (London, 1848), p. 389.

Defensive Weapons.

We may pass briefly over the defensive weapons of animals and savages, not by any means from the analogy being less perfect in this class of weapons, but rather because the similarity is too obvious to make it necessary that much stress should be laid on their resemblance.

Hides. The thick hides of pachydermatous animals correspond to the quilted armour of ancient and semi-civilized races. Some animals, like the rhinoceros and hippopotamus, are entirely armed in this way; others have their defences on the most vulnerable part, as the mane of the lion, and the shoulder pad of the boar.[1] The skin of the tiger is of so tough and yielding a nature, as to resist the horn of the buffalo when driven with full force against its sides.[2] The condor of Peru has such a thick coating of feathers, that eight or ten bullets may strike without piercing it.[3]

According to Thucydides, the Locrians and Acarnanians, being professed thieves and robbers, were the first to clothe themselves in armour.[4] But as a general rule it may be said, that the opinions of ancient writers upon the origin of the customs with which they were familiar, are of little value in our days. There is, however, evidence to show that the use of defensive armour is not usual amongst savages in the lowest stages of culture. It is not employed, properly speaking, by the Australians, the Bushmen, the Fuegians, or in the Fiji or Sandwich Islands. But in other parts of the world, soon after men began to clothe themselves in the skins of beasts, they appear to have used the thicker hides of animals for purposes of defence. When the Esquimaux apprehends hostility, he takes off his ordinary shirt, and puts on a deer's skin, tanned in such a manner as to render it thick for defence, and over this he again draws his ordinary shirt, which is also of deer-skin, but thinner in substance. The Esquimaux also use armour of eider drake's skin.[5] The Abipones and Indians of the Grand Chako arm themselves with a cuirass, greaves, and helmet, composed of the thick hide of the tapir, but they no longer use it against the musketry of the Europeans.[1] The Yucanas also use shields of the same material. The war-dress of a Patagonian chief from the Museum of the Institution is exhibited (Plate VII, figs. 11, 12); it is composed of seven thicknesses of hide, probably of the horse, upon the body, and three on the sleeves. The chiefs of the Musgu negroes of Central Africa use for defence a strong doublet of the same kind, made of buffalo's hide with the hair inside.[2] The Kayans of Borneo use hide for their war-dress, as shown by a specimen belonging to the Institution (Fig. 13). The skin of the bear and panther is most esteemed for this purpose.[3] The inhabitants of Pulo Nias, an island off the western coast of Sumatra, use for armour a 'baju' made of leather. In some parts of Egypt a breastplate was made of the back of the crocodile (Fig. 14). In the island of Cayenne, in 1519, the inhabitants used a breastplate of buffalo's hide.[4] The Lesghi of Tartary wore armour of hog's skin.[5] The Indians of Chili, in the seventeenth century, wore corselets, back and breast plates, gauntlets, and helmets of leather, so hardened, that it is described by Ovalle as being equal to metal.[6] According to Strabo (p. 306), the German Rhoxolani wore helmets, and breastplates of bull's hide, though the Germans generally placed little reliance in defensive armour. The Ethiopians used the skins of cranes and ostriches for their armour.[7]

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[1] Darwin, *Origin of Species* (London, 1859), p. 88.

[2] Williamson, *Oriental Field Sports* (London, 1807), p. 94.

[3] Swainson, *Habits and Instincts of Animals* (London, 1840), p. 142.

[4] Thuc. i. 5 (but what Thucydides says is, that they were the last to discard it.—Ed.).

[5] Beechey, *Voyage to the Pacific* (London, 1831), vol. i. p. 248.

We learn from Herodotus that it was from the Libyans the Greeks derived the apparel and aegis of Minerva, as represented upon her images, but instead of a pectoral of scale armour, that of the Libyans was merely of skin.[8] According to Smith's *Dict. of Gr. and Roman Antiquities* (s.v. *lorica*), the Greek 'thorax', called *σταδιος*, from its standing erect by its own stiffness, was originally of leather, before it was constructed of metal. In Meyrick's *Ancient Armour*, there is the figure of a suit, supposed formerly to have belonged to the Rajah of Guzerat (Plate VIII, fig. 15). The body part of this suit is composed of four pieces of rhinoceros hide, showing that, in all probability, this was the material originally employed for that particular class of armour, which is now produced of the same form in metal, a specimen of which, from the Museum of the Institution, taken from the Sikhs, is now exhibited (Fig. 16).

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[1] Dobrizhoffer, *An Account of the Abipones* (from the Latin; London, 1822), vol. i. p. 262; ii. 361.

[2] Barth, *Travels and Discoveries in North and Central Africa* (London, 1857), vol. iii. p. 198.

[3] Low, *Sarawak* (London, 1848), p. 328.

[4] Pigafetta's *Voyage Round the World*, Pinkerton, vol. ix. p. 349.

[5] William de Rubruquis, *Travels into Tartary and China in* 1253; Pinkerton (London, 1811), vol. viii. p. 89.

[6] *An Historical Relation of the Kingdom of Chile*, by Alonso de Ovalle, of the Company of Jesus, 1649 (London, 1752), p. 71.

[7] Herodotus, vii. 70; Meyrick's *Ancient Armour*, vol. i. Introd. p. iv.

[8] Herodotus, iv. 189; Meyrick's *Ancient Armour*, vol. i. Introd. p. iii.

In more advanced communities, as skins began to be replaced by woven materials, quilted armour supplied the place of hides. In those parts of the Polynesian Islands in which armour is used, owing probably to the absence of suitable skins, woven armour appears to have been employed in a comparatively low state of society. Specimens of this class of armour from the Museum of the Institution are exhibited; they are from the Kingsmill Islands, Pleasant Island, and the Sandwich Islands. A helmet from the latter place (Pl. VIII, fig. 17) much resembles the Grecian in form, while the under tippet, from Pleasant Island (Pl. VII, fig. 18), may be compared to the pectoral of the Egyptians (Fig. 19, *a* and *b*), which, as well as the head-dress (Pl. VIII, fig. 20), was of a thickly quilted material. The Egyptians wore this pectoral up to the time of Xerxes, who employed their sailors, armed in this way, during his expedition into Greece. Herodotus says that the Indians of Asia wore a thorax of rush matting.[1] In 1514, Magellan[2] found tunics of quilted cotton, called 'laudes', in use by the Muslims of Guzerat and the Deccan. An Indian helmet of this description from my collection (Fig. 21) is exhibited; in form it resembles the Egyptian, and an Ethiopian one (Fig. 22), composed of beads of the same form, brought from Central Africa by Consul Petherick, is exhibited. Fig. 23 shows that the same form, in India, was subsequently produced in metal. A suit of quilted armour formerly belonging to Koer Singh, and lately presented to the Institution by Sir Vincent Eyre, is also exhibited (Plate VII, fig. 24). The body armour and helmet found upon Tippoo Sahib at his death, which are now in the Museum of the Institution (Plate IX, fig. 25, *a*, *b*, and *c*), were thickly quilted. Upon the breast, this armour consists of two sheets of parchment, and nine thicknesses of padding composed of cocoons of the *Saturnia mylitta*, stuffed with the wool of the *Eriodendron anfractuosum, D.C.*, neatly sewn together, as represented in fig. 25 *b*.[1] The Aztecs and Peruvians also guarded themselves with a wadded cotton doublet.[2] Quilted armour or thick linen corselets were used by the Persians, Phoenicians, Chalybes, Assyrians, Lusitanians, and Scythians, by the Greeks, and occasionally by the Romans.[3] By the Persians it was used much later; and in Africa to this day, quilted armour, of precisely the same description, is used both for men and horses by the Bornouese of Central Africa, and is described by Denham and Clapperton[4] (Plate VIII, fig. 26). Plate VII, fig. 27, is a suit of armour in the Institution, from the Navigator Islands, composed of coco-nut fibre coarsely netted. Fig. 28 is part of a Chinese jacket of sky-blue cotton, quilted with enclosed plates of iron; it is precisely similar to the 'brigandine jacket' used in Europe in the sixteenth century, which was composed of 'small plates of iron quilted within some stuff', and 'covered generally with sky-blue cloth'.[1] This class of armour may be regarded as a link connecting the quilted with the scale armour, to be described hereafter.

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[1] Herodotus, vii. 65 *εἵματα . . . . ἀπὸ ξύλων πεποιημένα.*

[2] Duarte Barbosa, *The Coasts of East Africa and Malabar*, translated from the Spanish, by the Hon. H. E. Stanley (Hakluyt Society, 1866), p. 55. Since publication, the translator has ascertained that the authorship of this work should be ascribed to Magellan.

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[1] The *Saturnia mylitta* is the caterpillar from which the Tusseh-silk is obtained; the cocoon is of an oval shape when suspended upon the tree, and of exceedingly firm texture; it is figured in Sir Wm. Jardine's *Naturalist's Library* (Edinb. 1841), *Entomology*, vol. vii. pl. xiv. 2, pp. 146–53. The *Eriodendron anfractuosum, DC.*, is an Indian Bombax. The woolly cotton which envelops the seed is remarkable for its softness, and is much and deservedly esteemed for making cushions and bedding, owing to its freedom from any tendency to become lumpy and uneven by getting impacted into hard knots. Various attempts have been made to fabricate it into cloth, but hitherto without success, except as a very loose material, fit only for quilting muffs, for which it is superior to cotton or woollen stuffs, the looseness of its texture rendering it an excellent non-conductor, whilst at the same time it is extremely light.—Wight, *Illustrations of Indian Botany* (Madras, 1840), vol. i. p. 68; Roxburgh, *Flora Indica* (Serampore, 1832), vol. iii. p. 165 (=*Bombax pentandrum*). Both the caterpillar and the plant are found in the jungle in the neighbourhood of Seringapatam. For the identification of the vegetable substance, I am indebted to W. Carruthers, Esq., F.L.S., British Museum.

[2] Schoolcraft, *Information concerning the History, &c., of the Indian Tribes of the U. S. A.* (Philadelphia, 1851–9), part iii. p. 69.

[3] Meyrick, l. c., vol. i. Introduction.

[4] Denham and Clapperton, *Travels in Northern and Central Africa* (London, 1826), p. 328 (Denham).

As a material for shields, the hides of animals were employed even more universally, and up to a later stage of civilization. In North America the majority of the wild tribes use shields of the thickest parts of the hides of the buffalo.[2] In the New Hebrides the skin of the alligator is used for this purpose, as appears by a specimen belonging to the Institution. In Africa the Fans of the Gaboon employ the hide of the elephant for their large, rectangular shields.[3] The Wadi, the Wagogo, and the Abyssinians in East Africa, have shields of buffalo's hide, or some kind of leather, like the Ethiopians of the time of Herodotus. The ox-hide shields of the Greeks are mentioned in Homer's *Iliad*; that of Ajax was composed of seven hides with a coating of brass on the outside. The spear of Hector is described as piercing six of the hides and the brass coating, remaining fixed in the seventh hide.[4] The Kaffirs, Bechuanas, Basutos, and others in South Africa, use the hide of the ox.[5] The Kelgeres, Kelowi, and Tawarek, of Central Africa, employ the hide of the Leucoryx antelope.[6] Shields of the rhinoceros hide, from Nubia, and of the ox, from Fernando Po, are exhibited. In Asia the Biluchi carry shields of the rhinoceros horn, and the same material is also used in East Africa. A specimen from Zanzibar is in the Institution. In the greater part of India the shields are made of rhinoceros and buffalo's hide, boiled in oil, until they sometimes become transparent, and are proof against the edge of a sabre.[7]

In a higher state of civilization, as the facilities for constructing shields of improved materials increased, the skins of animals were still used to cover the outside. Thus the negroes of the

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[1] See *Critical Enquiry into Ancient Armour*, by Sir Samuel R. Meyrick, vol. iii. p. 21, and pl. lxviii.

[2] Bollaert, 'Observations on the Indian Tribes of Texas,' *Journ. Ethno. Soc.*, vol. ii. pp. 262–88.

[3] Du Chaillu, *Explorations and Adventures in Equatorial Africa* (London, 1861), p. 80.

[4] Homer, *Iliad*, vii. 244–8.

[5] Casalis, *The Basutos* (London, 1861), pp. 135–6.

[6] Barth, l. c., vol. i. p. 355.

[7] Meyrick (Skelton), l. c., pl. cxli (text).

Gold Coast made their shields of osier covered with leather.[1] That of the Kanembu of Central Africa is of wood covered with leather,[2] and very much resembles in form that of the Egyptians, which, as we learn from Meyrick and others, was also covered with leather, having the hair on the outside like the shields of the Greeks.[3] The Roman 'scutum' was of wood covered with linen and sheepskin. According to the author of *Horae Ferales*, the Saxon shield was of wood covered with leather; the same applies to the Scotch target, and leather was used as a covering for shields as late as the time of Henry VIII.

Head Crests. The origin of the hairy crests of our helmets is clearly traceable to the custom of wearing for head-dresses the heads and hair of animals. The Asiatic Ethiopians used as a head-covering, the skin of a horse's head, stripped from the carcase together with the ears and mane, and so contrived, that the mane served for a crest, while the ears appeared erect upon the head (Hdt. vii. 70). In the coins representing Hercules, he appears wearing a lion's skin upon the head. These skins were worn in such a manner that the teeth appeared grinning at the enemy over the head of the wearer (as represented in Plate VIII, fig. 29, which is taken from a bronze in the Blacas collection), a custom which seems also to have prevailed in Mexico.[4] Similar head-dresses are worn by the soldiers on Trajan's Column. The horns worn on the heads of some of the North American Indians (Fig. 30), and in some parts of Africa [5], are no doubt derived from this practice of wearing on the head the skins of animals with their appendages. The helmet of Pyrrhus, King of Epirus, was surmounted by two goat's horns. Horns were afterwards represented in brass, on the helmets of the Thracians (Fig. 31), the Belgic Gauls, and others. Fig. 32 is an ancient British helmet of bronze lately found in the Thames, surmounted by straight horns of the same material.[6] Horned helmets are figured on the ancient vases. Fig. 33 is a Greek helmet having horns of brass, and traces of the same custom may still be observed in heraldry.[1]

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[1] Bosman, *Guinea*, Pinkerton (1811), vol. xvi. p. 414.

[2] Barth, l. c., vol. ii. pp. 410, 526; ii. 116 (plate); Denham and Clapperton, l. c., p. 166 (Denham).

[3] Meyrick, l. c., vol. i. Introd. pp. i–ii.

[4] Meyrick, l. c., vol. i. Introd. p. xxiv.

[5] At Fernando Po.—Cuming, 'Weapons and Armour of Horn,' *Journal of Archaeological Association* (London, 1848), vol. iii. p. 30.

[6] Fig. 32 is from a rough sketch taken about two years ago, and has no pretension to accuracy of detail.

The practice of wearing head-dresses of feathers, to distinguish the chiefs from the rank and file, is universal in all parts of the world, and in nearly every stage of civilization. Amongst the North American Indians the feathers are cut in a particular manner to denote the rank of the wearer, precisely in the same manner that the long feathers of our general officers distinguish them from those wearing shorter feathers in subordinate ranks. This custom, Mr. Schoolcraft observes, when describing the head-dresses of the American Indians, may very probably be derived from the feathered creation, in which the males, in most of the cock, turkey, and pheasant tribes, are crowned with bright crests and ornaments of feathers.[2]

Solid Plates. It has often struck me as remarkable that the shells of the tortoise and turtle, which are so widely distributed and so easily captured, and which would appear to furnish shields ready made to the hand of man, should seldom, if ever, in so far as I have been able to learn, be used by savages for that purpose. This may, however, be accounted for by the fact that *broad* shields of that particular form, though common in more advanced civilizations, are never found in the hands of savages, at least in those localities in which the turtle, or large tortoise, is available.

It will be seen subsequently, in tracing the history of the shield, that in the rudest condition of savage life, this weapon of defence has a history of its own; that both in Africa and Australia it is derived by successive stages from the stick or club, and that the broad shield does not appear to have been developed until after mankind had acquired sufficient constructive skill to have been able to form shields of lighter and more suitable materials than is afforded by the shell of the turtle. It is, however, evident that in later times the analogy was not lost sight of, as the word 'testudo' is a name given by the Romans to several engines of war having shields attached to them, and especially to that particular formation of the legionary troops, in which they approached a fortified building with their shields joined together, and overlapping, like the scaly shell of the imbricated turtle, which is a native of the Mediterranean and Asiatic seas.

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[1] Meyrick, l. c., vol. i. pl. iv. 10.

[2] Schoolcraft, *Information concerning the History, &c., of the Indian Tribes of the U.S.A.* (Philadelphia, 1851–9), vol. iii. p. 67.

Jointed Plates. In speaking of the jointed plates, so common to all the crustacea, it is sufficient to notice that this class of defence in the animal kingdom, may be regarded as the prototype of that peculiar form of armour which was used by the Romans, and to which the French, at the commencement of the seventeenth century, gave the name of 'écrevisse', from its resemblance to the shell of a lobster. The fluted armour, common in Persia, and in the middle ages of Europe, is also constructed in exact imitation of the corrugated shell defences of a large class of the Mollusca.

Scale Armour. That scale armour derived its origin from the scales of animals, there can be little doubt. It has been stated on the authority of Arrian (*Tact.* 13. 14), that the Greeks distinguished scale armour by the term *λεπιδωτός*, expressive of its resemblance to the scales of fish; whilst the jointed armour, composed of long flexible bands, like the armour of the Roman soldier, and the 'écrevisse' of the middle ages, was called *φολιδωτός* from its resemblance to the scales of serpents. The brute origin of scale armour is well illustrated by the breastplate of the Bugo Dyaks, a specimen of which, from the Museum of the Institution, is represented in Plate IX, fig. 34. The process of its construction was described in a notice attached to a specimen of this armour in the Exhibition of 1862. The scales of the Pangolin are collected by the Bugis as they are thrown off by the animal, and are stitched on to bark with small threads of cane, so as to overlap each other in the same manner that they are arranged on the skin of the animal. When the front piece is completely covered with scales, a hole is cut in the bark for the head of the wearer. The specimen now exhibited appears, however, to be composed of the entire skin of the animal. Captain Grant, in his *Walk across Africa*, mentions that the scales of the armadillo are in like manner collected by the negroes of East Africa, and worn in a belt 'three inches across', as a charm.[1]

It is reasonable to suppose that the use of scale armour, in most countries, originated in this manner by sewing on to the quilted armour before described, fragments of any hard material calculated to give it additional strength. Plate VIII, fig. 35, is a piece of bark from Tahiti, studded with pieces of coco-nut stitched on. The Sarmatians and Quadi are described by Ammianus Marcellinus as being protected by a 'lorica', composed of pieces of horn, planed and polished, and fastened like feathers upon a linen shirt.[1] Pausanias also, who is confirmed by Tacitus, says that the Sarmatians had large herds of horses, that they collected the hoofs, and after preparing them for the purpose, sewed them together, with the nerves and sinews of the same animal, so as to overlap each other like the surface of a fir cone, and he adds, that the 'lorica' thus formed was not inferior to that of the Greeks either in strength or elegance. The Emperor Domitian had, after this model, a cuirass of boar's hoofs stitched together.[2] Fig. 36 represents a fragment of scale armour made of horn, found at Pompeii. A very similar piece of armour (Fig. 37), from some part of Asia, said to be from Japan, but the actual locality of which is not known, is figured in Meyrick's *Ancient Armour*, pl. iii. 1. It is made of the hoofs of some animal, stitched and fastened so as to hold together without the aid of a linen corselet. An ancient stone figure[3] (Plate IX, fig. 38), having an inscription in a character cognate to the Greek, but in an unknown language, and covered with armour of this description, is represented in the third volume of the *Journal of the Archaeological Association*. The Kayans, inhabiting the eastern coast of Borneo, form a kind of armour composed of little shells placed one overlapping the other, like scales, and having a large mother-of-pearl shell at the end. This last portion of the armour is shown in the figure of the Kayan war-dress already referred to (Plate VII, fig. 13). Plate VIII, fig. 39, is a back- and breast-piece of armour from the Sandwich Islands, composed of seals' teeth, set like scales, and united with string.

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[1] Grant, *Walk across Africa* (London, 1864), p. 47.

Similar scales would afterwards be constructed in bronze and iron. It was thus employed by the Egyptians (Plate IX, fig. 40), two scales of which are shown in Fig. 41; also by the Persians, Assyrians, Philistines, Dacians, and most ancient nations.

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[1] Smith, *Dict. of Gr. and Rom. Antiq.*, s. v.; Meyrick, l. c., vol. i. Introd. p. xiv; Amm. Marc. xvii. 12. 2; Pausanias, i. 21. 6; Tac. *Hist.* i. 79 (*praeduro corio*).

[2] Kitto, *Pictorial Bible* (London, 1838–9), note to 1 Sam. xvii.

[3] Cuming, *Journal of the Archaeological Association*, vol. iii. p. 31.

The armour of Goliath is believed to have been of scales, from the fact of the word 'kaskassim', used in the text of 1 Sam. xvii, being the same employed in Leviticus and Ezekiel, to express the scales of fish.[1] Amongst the Romans, scale armour was regarded as characteristic of barbarians, but they appear to have adopted it in the time of the Emperors. A suit of Japanese armour in my collection shows four distinct systems of defence, the back and breast being of solid plates, the sleeves and leggings composed of small pieces of iron, stitched on to cloth, and united with chain, whilst other portions are quilted with enclosed pieces of iron (Fig. 42, *a* and *b*). Fig. 43, *a* and *b*, is a suit of Chinese armour, in the Museum, having large iron scales on the inside (Fig. 44). This system was also employed in Europe. Fig. 45 is the inner side of a suit of 'jazerine' armour of the fifteenth or sixteenth century, in my collection. Fig. 46 represents a similar suit in the Museum of the Institution, probably of the same date, having large scales of iron on the outside. A last vestige of scale armour may be seen in the dress of the Albanians, which, like the Scotch and ancient Irish kilt, and that formerly worn by the Maltese peasantry, is a relic of costume of the Greek and Roman age. In the Albanian jacket the scales are still represented in gold embroidery.[2]

Offensive Weapons of Men and Animals.

Piercing Weapons. The Gnu of South Africa, when pressed, will attack men, bending its head downwards, so as to pierce with the point of its horn.[3] The same applies to many of the antelope tribe. The rhinoceros destroys the elephant with the thrust of its horn, ripping up the belly (Plate X, fig. 47). The horn rests on a strong arch formed by the nasal bones; those of the African rhinoceros, two in number, are fixed to the nose by a strong apparatus of muscles and tendons, so that they are loose when the animal is in a quiescent state, but become firm and immovable when he is enraged, showing in an especial manner that this apparatus is destined for warlike purposes.[1] It is capable of piercing the ribs of a horse, passing through saddle, padding, and all.[2] Mr. Atkinson, in his Siberian travels, speaks of the tusk of the wild boar, which in those parts is long, and as sharp as a knife, and he describes the death of a horse which was killed by a single stroke from this animal, delivered in the chest.[3] The buffalo charges at full speed with its horn down.[4] The bittern, with its beak, aims always at the eye.[5] The walrus (Fig. 48) attacks fiercely with its pointed tusks, and will attempt to pierce the side of a boat with them.[6] The needle-fish of the Amazons is armed with a long pointed lance.[7] The same applies to the sword-fish of the Mediterranean and Atlantic (Fig. 49), which, notwithstanding its food is mostly vegetable, attacks the whale with its spear-point on all occasions of meeting. There is an instance on record, of a man, whilst bathing in the Severn near Worcester, having been killed by the sword-fish.

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[1] Kitto, *Pictorial Bible*, note to 1 Sam. xvii.

[2] Skene, 'On the Albanians,' *Journ. Ethno. Soc.*, vol. ii. pp. 159-81.

[3] Casalis, *The Basutos* (London, 1861), p. 172.

The weapon of the sword-fish is used as a spear-head by the wild tribes of Cambodia, and some idea may be formed of its efficiency for this purpose, and of the confidence with which it is used, by the following account of an attack on a rhinoceros with this weapon, by Mons. Mouhot.[8] He says:—

'The manner in which the rhinoceros is hunted by the Laotians is curious, on account of its simplicity and the skill they display.... They had bamboos, with iron blades, something between a bayonet and a poignard. The weapon of the chief was the horn of a sword-fish, long, sharp, strong, supple, and not likely to break. Thus armed, we set off into the thickest part of the forest, with all the windings of which our leader was familiar, and could tell with tolerable certainty where we should find our expected prey. After penetrating nearly two miles into the forest, we suddenly heard the crackling of branches, and rustling of the dry leaves. The chief went on in advance, signing to us to keep a little way behind, but to have our arms in readiness. Soon our leader uttered a shrill cry, as a token that the animal was near; he then commenced striking against each other two bamboo canes, and the men set up wild yells to provoke the animal to quit his retreat.

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[1] Maunder, *Treasury of Natural History* (London, 1862), p. 573.

[2] Williamson, *Oriental Field Sports* (London, 1807), p. 46.

[3] Atkinson, *Oriental and Western Siberia* (London, 1858), p. 495.

[4] Williamson, *Oriental Field Sports* (London, 1807), p. 94.

[5] Thompson, *Passions of Animals* (1851), p. 225. The American hunter avails himself of this peculiarity to entrap the crane by presenting the barrel of his firelock to the animal; supposing it to be an eye, the crane immediately strikes at the hole, and fixes its beak firmly in the muzzle.

[6] Beechey, *Voyage to the North Pole* (London, 1843), pp. 93–4.

[7] Bates, *Naturalist on the Amazons* (3rd ed. London, 1873), p. 230.

[8] *Travels in the Central Parts of Indo-China, Siam, Cambodia, and Laos in* 1858–9, by the late M. Henri Mouhot (London, 1864), vol. ii. p. 147.

'A few minutes only elapsed before he rushed towards us, furious at having been disturbed. He was a rhinoceros of the largest size, and opened a most enormous mouth. Without any sign of fear, but on the contrary of great exultation, as though sure of his prey, the intrepid hunter advanced, lance in hand, and then stood still, waiting for the creature's assault. I must say I trembled for him, and loaded my gun with two balls; but when the rhinoceros came within reach, and opened his immense jaws to seize his enemy[1], the hunter thrust his lance into him to a depth of some feet, and calmly retired to where we were posted.' After the animal was dead, the chief withdrew his sword-fish blade, and presented it to Mons. Mouhot.

The narwhal has a still more formidable weapon of the same kind (Pl. X, fig. 50). It attacks the whale, and occasionally the bottoms of ships, a specimen of the effect of which attack, from the Museum of the Institution, is represented in Fig. 51. The Esquimaux, who, in the accounts which they give of their own customs, profess to derive much experience from the habits of the animals amongst which they live, use the narwhal's tusk for the points of their spears. Fig. 52 represents a 'nuguit' from Greenland, of the form mentioned by Cranz[2]; it is armed with the point of the narwhal's tusk. Fig. 53, from my collection, has the shaft also of narwhal's tusk; it is armed with a metal blade, but it is introduced here in order to show the association which existed in the mind of the constructor between his weapon and the animal from which the shaft is derived, and for the capture of which it is chiefly used. The wooden shaft, it will be seen, is constructed in the form of the fish, and the ivory fore-shaft is inserted in the snout in the exact position of that of the fish itself. At Kotzebue Sound, Captain Beechey[1] found the natives armed with lances composed of a walrus tooth fixed to the end of a wooden staff (Fig. 54). They also employ the walrus tooth for the points of their tomahawks (Fig. 55). The horns of the antelope are used as lance-points by the Djibba negroes of Central Africa, as already mentioned (p. 52), and in Nubia also by the Shillooks and Dinkas.[2] The antelope's horn is also used in South Africa for the same purpose.[3] The argus pheasant of India[4], the wing-wader of Australia[5], and the plover of Central Africa[6], have spurs on their wings, with which they fight; the cock and turkey have spurs on their feet, used expressly for offence. The white crane of America has been known to drive its beak deep into the bowels of a hunter.[7] The Indians of Virginia, in 1606, are described as having arrows armed with the spurs of the turkey and beaks of birds.[8] In the Christy collection there is an arrow, supposed to be from South America, which is armed with the natural point of the deer's horn (Fig. 56). The war-club of the Iroquois, called GA-NE-U′-GA-O-DUS-HA, or 'deer-horn war-club', was armed with a point of the deer's horn (Fig. 57), about 4 inches in length; since communication with Europeans, a metal point has been substituted (Fig. 58). It appears highly probable that the 'martel-de-fer' of the fifteenth and sixteenth centuries, which is also used in India and Persia, may have been derived, as its form indicates, from a horn weapon of this kind. Horn points suitable for arming such weapons have been found both in England and Ireland, two specimens of which are in my collection.[1] The weapon of the sting-ray, from the method of using it by the animal itself, should more properly be classed with serrated weapons, but it is a weapon in general use amongst savages for spear or arrow points (Fig. 59), for which it has the particular merit of breaking off in the wound. It causes a frightful wound, and being sharply serrated, as well as pointed, there is no means of cutting it out. It is used in this way by the inhabitants of Gambier Island, Samoa[2], Otaheite[3], the Fiji Islands[4], Pellew Islands[5], and many of the Low Islands. Amongst the savages of tropical South America, the blade of the ray, probably the *Trygon histrix*, is used for arrow-points.[6]

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[1] It is to be observed that this is not the rhinoceros's usual mode of attack.

[2] Cranz, *Historie von Grönland* (2nd ed. Barby and Leipzig, 1770), p. 196, pl. v. 8.

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[1] Beechey, *Voyage to the North Pole* (London, 1843), p. 252.

[2] Cuming, *Journal of the Archaeological Association*, vol. iii. p. 25.

[3] Ibid., p. 26.

[4] Swainson, *Habits and Instincts of Animals* (London, 1840), p. 141.

[5] Gregory, 'Expedition to the North-west Coast of Australia,' *Royal Geographical Society's Journal*, vol. xxxii (1862), p. 417.

[6] Denham and Clapperton, *Travels* (1826), p. 20 (Denham).

[7] Hind, *Narrative of the Canadian Exploring Expedition* (London, 1860), vol. i. p. 316.

[8] Captain John Smith, *Sixth Voyage to Virginia* (1606); Pinkerton (1811), vol. xii. p. 35.

In the *Balistes capriscus* (Fig. 60 *a*), a rare British fish, the anterior dorsal is preceded by a strong erectile spine, which is used for piercing other fishes from beneath. Its base is expanded and perforated, and a bolt from the supporting plate passes freely through it. When this spine is raised, a hollow at the back receives a prominence from the next bony ray, which fixes the spine in an erect position, as the hammer of a gun-lock acts at full-cock, and the spine cannot be forced down till this prominence is withdrawn, as by pulling the trigger. This mechanism may be compared to the fixing and unfixing of a bayonet; when the spine is unfixed and bent down, it is received into a groove on the supporting plate, and offers no impediment to the progress of the fish through the water. These fishes are also found in a fossil state, and, to use the words of Professor Owen, from whose work this description of the *Balistes* is borrowed, exemplify in a remarkable manner the efficacy, beauty, and variety of the ancient armoury of that order.[7] The stickleback is armed in a similar manner, and is exceedingly pugnacious. The *Cottus diceraus, Pall.* (Fig. 60 *b*), has a multi-barbed horn on its back, exactly resembling the spears of the Esquimaux, South American, and Australian

[1] Cuming, *Journal of the Archaeological Association*, vol. iii. p. 27.

[2] Turner, *Nineteen Years in Polynesia* (London, 1861), p. 276.

[3] Beechey, *Voyage to the Pacific* (London, 1831), vol. i. p. 143.

[4] Williams, *Fiji and the Fijians* (London, 1858), vol. i. p. 57.

[5] Wilson, *Pellew Islands* (ed. Keate, London, 1788), pl. v, fig. 1, p. 310.

[6] Klemm, *Werkzeuge und Waffen* (1858), p. 50.

[7] Owen, *Comp. Anatomy and Physiology of Vertebrates* (1846), vol. ii. 1. p

savages. The *Naseus fronticornis, Lac.* (Fig. 60 *c*), has also a spear-formed weapon. The Yellow-bellied Acanthurus is armed with a spine of considerable length upon its tail.

The Australians of King George's Sound use the pointed fin of the roach to arm their spears[1]; the inhabitants of New Guinea also arm their arrows with the offensive horn of the saw-fish, and with the claw of the cassowary. The sword of the Limulus, or king-crab, is an offensive weapon; its habits do not appear to be well understood, but its weapon is used in some of the Malay islands for arrow-points (Fig. 61). The natives of San Salvador, when discovered by Columbus, used lances pointed with the teeth of fish.[2] The spine of the Diodon is also used for arrow-points (Fig. 62). Amongst other piercing weapons suggested by the horns of animals may be noticed the Indian 'kandjar' composed of one side of the horn of the buffalo, having the natural form and point (Fig. 63). In later times a metal dagger, with ivory handle, was constructed in the same country (Fig. 64), after the exact model of the one of horn, the handle having one side flat, in imitation of the half-split horn, though of course that peculiar form was no longer necessitated by the material then used. The same form of weapon was afterwards used with a metal handle (Fig. 65). The sharp horns of the 'sasin', or common antelope, often steel pointed, are still used as offensive weapons in India (Figs. 66, 67, 68). Several examples of these are in the Museum of the Institution. Three stages of this weapon are exhibited, the first having the natural point, the second a metal point, and the third a weapon of nearly the same form composed entirely of metal. The Fakirs and Dervishes, not being permitted by their profession to carry arms, use the pointed horn of the antelope for this purpose. Fig. 69 is a specimen from my collection; from its resemblance to the Dervishes' crutch of Western Asia, I presume it can be none other than the one referred to in the *Journal of the Archaeological Association*, from which I obtained this information respecting the Dervishes' weapon.[3] Mankind would also early derive instruction from the sharp thorns of trees, with which he must come in contact in his rambles through the forests; the African mimosa, the Gledischia, the American aloe, and the spines of certain palms, would afford him practical experience of their efficacy as piercing weapons, and accordingly we find them often used by savages in barbing their arrows.[1]

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[1] Klemm, l. c., p. 31 ('die Schwanzstachel eines Roches,' i.e. 'the caudal spine of a ray.'—Ed.).

[2] Wilson, *Prehistoric Man* (London, 1862), vol. i. p. 146.

[3] Cuming, *Journal of the Archaeological Association*, vol. iii. p. 26.

Striking Weapons. Many animals defend themselves by blows delivered with their wings or legs; the giraffe kicks like a horse as well as strikes sideways with its blunt horns; the camel strikes with its fore legs and kicks with its hind legs; the elephant strikes with its proboscis and tramples with its feet; eagles, swans, and other birds strike with their wings; the swan is said to do so with sufficient force to break a man's leg; the cassowary strikes forward with its feet; the tiger strikes a fatal blow with its paw; the whale strikes with its tail, and rams with such force, that the American whaler *Essex* is said to have been sunk by that animal.[2] There is no known example of mankind in so low a state as to be unacquainted with the use of artificial weapons. The practice of boxing with the fist, however, is by no means confined to the British Isles as some people seem to suppose, for besides the Romans, Lusitanians[3], and others mentioned in classical history, it prevailed certainly in the Polynesian islands[4] and in Central Africa.[5]

Serrated Weapons. This class of weapons in animals corresponds to the cutting weapons of men. Amongst the most barbarous races, however, as amongst animals, no example of a cutting weapon is found[6]: although the Polynesian islanders make very good knives of the split and sharpened edges of bamboo, and the Esquimaux, also, use the split tusk of the walrus as a knife, these cannot be regarded, nor, indeed, are they used, as edged weapons. These, strictly speaking, are confined to the metal age, and their place, in the earliest stages of civilization, is supplied by weapons with serrated, or saw-like edges.

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[1] The probability of the aboriginal man having derived his first lessons from this source may be judged of by the accounts given by travellers of the effects produced by the large thorns of trees in South Africa, of which there is a good account in Routledge's *Natural History of Man*, by Rev. J. G. Wood (1868–70), vol. i. p. 235. Large animals are said to be frequently destroyed, and even to have impaled themselves, upon the large, strong spines of the thorny Acacia. Throughout Central Africa a pair of tweezers for extracting thorns is an indispensable requisite in the equipment of every native.

[2] Beechey, *Voyage to the Pacific* (London, 1831), vol. i. pp. 47–8.

[3] Strabo, p. 155.

[4] Ellis, *Polynesian Researches* (London, 1829), vol. i. chap. viii.

[5] Clapperton, *Travels*, p. 58.

[6] I exclude from this category all nippers, cross-bills, and prehensile implements.

Perhaps the nearest approach in the animal kingdom to an edged weapon is the fore-arm of the mantis, a kind of cricket, used by the Chinese and others in the East for their amusement. Their combats have been compared to that of two soldiers fighting with sabres. They cut and parry with their fore-arms, and, sometimes, a single stroke with these is sufficient to decapitate, or cut in two the body of an antagonist. But on closer inspection, these fore-arms are found to be set with a row of strong and sharp spines, similar to those of all other animals that are provided with this class of weapon. The snout of the saw-fish is another example of the serrated weapon. Its mode of attacking the whale is by jumping up high in the air, and falling on the animal, not with the point, but with the sides of its formidable weapon, both edges of which are armed with a row of sharp horns, set like teeth, by means of which it rasps a severe cut in the flesh of the whale. The design in this case is precisely analogous to that of the Australian savage, who throws his similarly constructed spear so as to strike, not with the bone point, but with its more formidable edges, which are thick set with a row of sharp-pointed pieces of obsidian, or rock-crystal. The saw-fish is amongst the most widely distributed of fishes, belonging to the arctic, antarctic, and tropical seas. It may, therefore, very possibly have served as a model in many of the numerous localities in which this character of weapon is found in the hands of savages. The snout itself is used as a weapon by the inhabitants of New Guinea, the base being cut and bound round so as to form a handle. Plate XI, fig. 70, is a specimen from the Museum of the Institution. The weapon of the sting-ray, though used by savages for spear-points, more properly belongs to this class, as the mode of its employment by the animal itself consists in twisting its long, slender tail round the object of attack, and cutting the surface with its serrated edge.[1]

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[1] Jardine's *Naturalist's Library* (Edinb. 1843): *Ichthyology* (Hamilton), vol. vi, part 2, p. 335.

The teeth of all animals, including those of man himself, also furnish examples of serrated weapons.

When we find models of this class of weapon so widely distributed in the lower creation, it is not surprising that the first efforts of mankind in the construction of trenchant implements, should so universally consist of teeth or flint flakes, arranged along the edges of staves or clubs, in exact imitation of the examples which he finds ready to his hand, in the mouths of the animals which he captures, and on which he is dependent for his food. Several specimens of implements, edged in this manner with sharks' teeth, from the Museum of the Institution, are represented in Plate XI, figs. 71, 72, 73, 74. They are found chiefly in the Marquesas, in Tahiti, Depeyster's Island, Byron's Isles, the Kingsmill Group, Radak Island[1], and the Sandwich Islands[2], also in New Zealand (Fig. 75). They are of various shapes, and are used for various cutting purposes, as knives, swords, and glaves. Two distinct methods of fastening the teeth to the wood prevail in the Polynesian Islands; firstly, by inserting them in a groove cut in the sides of the stick or weapon; and secondly, by arranging the teeth in a row, along the sides of the stick, between two small strips of wood on either side of the teeth, lashed on to the staff, in all cases, with small strings, composed of plant fibre. The points of the teeth are usually arranged in two opposite directions on the same staff, so that a severe cut may be given either in thrusting or withdrawing the weapon.[3]

A similarly constructed implement, also edged with sharks' teeth, was found by Captain Graah on the east coast of Greenland, and is mentioned in Dr. King's paper on the industrial arts of the Esquimaux, in the *Journal of the Ethnological Society*.[4] The teeth in this implement were secured by small nails, or pegs of bone; it was also used formerly on the West Coast. A precisely similar implement (Fig. 76), but showing an advance in art by being set with a row of chips of meteoric iron, was found amongst the Esquimaux of Davis Strait, and is now in the department of meteorolites in the British Museum. Others, of the same nature, from Greenland, are in the Christy collection (Fig. 77). The 'pacho' of the South Sea Islands appears to have been a sort of club, armed on the inner side with sharks' teeth, set in the same manner.[1] The Tapoyers, of Brazil, used a kind of club, which was broad at the end, and set with teeth and bones, sharpened at the point.[2]

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[1] Choris, *Voyage Pictoresque autour du Monde* (Paris, 1822), 'Isles Radak,' pl. ii. 1 and 4.

[2] Cook, *Third Voyage* (London, 1842), vol. ii. p. 251.

[3] Klemm, l. c., pp. 63–4; Wilkes, *United States Exploring Expedition* (Philadelphia, 1845), vol. v. ch. ii. pp. 49, 79.

[4] King, 'The Industrial Arts of the Esquimaux,' *Journ. Ethno. Soc.* (1848), vol. i. p. 290.

Hernandez gives an account of the construction of the Mexican 'maquahuilt' or Aztec war-club, which was armed on both sides with a row of obsidian flakes, stuck into holes, and fastened with a kind of gum (Fig. 78).[3] Herrera, the Spanish historian, also mentions these as swords of wood, having a groove in the fore part, in which the flints were strongly fixed with bitumen and thread.[4] In 1530, according to the Spanish historians, Copan was defended by 30,000 men, armed with these weapons, amongst others[5]; and similar weapons have been represented in the sculptures of Yucatan.[6] They are also represented in Lord Kingsborough's important work on Mexican antiquities, from which the accompanying representations are taken (Figs. 78, 79, 80). One of these swords, having six pieces of obsidian on each side of the blade, is to be seen in a Museum in Mexico.

In the burial mounds of Western North America, Mr. Lewis Morgan, the historian of the Iroquois,[7] mentions that rows of flint flakes have been found lying, side by side, in order, and suggesting the idea that they must have been fastened into sticks in the same manner as those of Mexico and Yucatan.

Throughout the entire continent of Australia the natives arm their spears with small sharp pieces of obsidian, or crystal, and recently of glass, arranged in rows along the sides near the point, and fastened with a cement of their own preparation, thereby producing a weapon which, though thinner in the shaft, is precisely similar in character to those already described (Figs. 81 and 82). Turning again to the northern hemisphere, we find in the Museum of Professor Nilsson, at Lund, in Sweden, a smooth, sharp-pointed piece of bone, found in that country, about six inches long, grooved on each side to the depth of about a quarter of an inch, into each of which grooves a row of fine, sharp-edged, and slightly-curved flints were inserted, and fixed with cement. The instrument thus armed was fastened to the end of a shaft of wood, and might either have been thrown by the hand or projected from a bow (Fig. 83). Another precisely similar implement (Fig. 84) is represented in the illustrated Catalogue of the Museum at Copenhagen, showing that in both these countries this system of constructing trenchant implements was employed. In Ireland, although there is no actual evidence of flints having been set in this manner, yet from the numerous examples of this class of weapon that are found elsewhere, and the frequent occurrence of flint implements of a form that would well adapt them to such a purpose, the author of the Catalogue of the Royal Irish Academy expresses his opinion that the same arrangement may very possibly have existed in that country, and that the wood in which they were inserted may, like that which, as I have already said, is supposed to have held the flints found in the graves of the Iroquois, have perished by decay.

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[1] Ellis, *Polynesian Researches*, vol. ii. p. 497.

[2] Nieuhoff, 'Travels in Brazil'; Pinkerton (1813), vol. xiv. p. 874.

[3] Tylor, *Anahuac*, p. 332, Appendix.

[4] Wilson, *Prehistoric Man* (1862), vol. i. pp. 226, 227.

[5] Lloyd Stephens, *Incidents of Travel in Central America*, p. 59.

[6] Wilson, *Prehistoric Man* (1862), vol. i. pp. 226, 227.

[7] Lewis Morgan, *The League of the Ho-De-No-Sou-Nee or Iroquois* (Rochester, N.Y., 1851), p. 359.

Poisoned Weapons. It is unnecessary to enter here into a detailed account of the use of poison by man and animals. Its use by man as a weapon of offence is chiefly confined to those tropical regions in which poisonous herbs and reptiles are most abundant. It is used by the Negroes, Bushmen, and Hottentots of Africa; in the Indian Archipelago, New Hebrides, and New Caledonia. It appears formerly to have been used in the South Seas. It is employed in Bootan; in Assam; by the Stiens of Cambodia; and formerly by the Moors of Mogadore. The Parthians and Scythians used it in ancient times; and it appears always to have been regarded by ancient writers as the especial attribute of barbarism. The Italian bravoes of modern Europe also used it. In America it is employed by the Darian Indians, in Guiana, Brazil, Peru, Paraguay, and on the Orinoco. The composition of the poison varies in the different races, the Bushmen and Hottentots using the venomous secretions of serpents and caterpillars,[1] whilst most other nations of the world employ the poisonous herbs of the different countries they inhabit, showing that in all probability this must have been one of those arts which, though of very early origin, arose spontaneously and separately in the various quarters of the globe, after the human family had separated. This subject, however, is deserving of a separate treatment, and will be alluded to elsewhere.

In drawing a parallel between the weapons of men and animals used in the application of poison for offensive purposes, two points of similitude deserve attention.

Firstly, the poison gland of many serpents is situated on the upper jaw, behind and below the eyes. A long excretory duct extends from this gland to the outer surface of the upper jaw, and opens above and before the poison teeth, by which means the poison flows along the sheath into the upper opening of the tooth in such a manner as to secure its insertion into the wound. The hollow interior of the bones with which the South American and other Indians arm the poisoned arrows secures the same object (Fig. 85); it contains the poisonous liquid, and provides a channel for its insertion into the wound. In the bravo's dagger of Italy, a specimen of which from my collection is shown in Fig. 86, a similar provision for the insertion of the poison is effected by means of a groove on either side of the blade, communicating with two rows of small holes, into which the poison flows, and is retained in that part of the blade which enters the wound. Nearly similar blades, with holes, have been found in Ireland, of which a specimen is in the Academy's Museum, and they have been compared with others of the same kind from India, but I am not aware that there is any evidence to show that they were used for poison. Some of the Indian daggers, however, are constructed in close analogy with the poison apparatus of the serpent's tooth, having an enclosed tube running down the middle of the blade, communicating with a reservoir for poison in the handle, and having lateral openings in the blade for the diffusion of the poison in the wound. Similar holes, but without any enclosed tube, and having only a groove on the surface of the blade to communicate with the holes, are found in some of the Scotch dirks, and in several forms of *couteau de chasse*, in which they appear to have been used merely with a view of letting air into the wound, and accelerating death (Figs. 87 *a* and *b*). The Scotch dirk, here represented, has a groove running from the handle along the back of the blade to within three and a half inches of the point. In the bottom of this groove ten holes are pierced, which communicate with other lateral holes at right angles, opening on to the sides of the blade. Daggers are still made at Sheffield for the South American market, with a small hole drilled through the blade, near the point, to contain the poison; and in my collection there is an iron arrow-point (Fig. 88), evidently formed of the point of one of these daggers, having the hole near the point.

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[1] Thunberg, *Travels in Europe, Africa, and Asia*, 1770–9 (3rd ed., London, 1795), vol. i. p. 156; ii. p. 162; Livingstone, *Missionary Travels and Researches in South Africa* (London, 1857), p. 171.

It often happens that forms which, in the early history of an art, have served some specific object, are in later times applied to other uses, and are ultimately retained only in the forms of ornamentation. This seems to have been the case with the pierced work upon the blades of weapons which, intended originally for poison, was afterwards used as air-holes, and ultimately for ornament only, as appears by a plug bayonet of the commencement of the eighteenth century in the Tower Armoury, No. 390 of the official Catalogue, for a drawing of which, as well as that of the Scotch dirk, I am indebted to Captain A. Tupper, a member of the Council of this Institution.

The second point of analogy to which I would draw attention is that of the multi-barbed arrows of most savages to the multi-barbed stings of insects, especially that of the bee (Fig. 89), which is so constructed that it cannot usually be withdrawn, but breaks off with its poisonous appendage into the wound. An exact parallel to this is found in the poisoned arrows of savages of various races, which, as already mentioned, are frequently armed with the point of the sting-ray, for the express purpose of breaking in the wound. In the arrows of the Bushmen, the shaft is often partly cut through, so as to break when it comes in contact with a bone, and the barb is constructed to remain in the wound when the arrow is withdrawn (Fig. 90). The same applies to the barbed arrows used with the Malay blowpipe (Fig. 91), and those of the wild tribes of Assam (Fig. 92), which are also poisoned. The arrow-points of the Shoshones of North

America (Fig. 93), said to be poisoned, are tied on, purposely, with gut in such a manner as to remain when the arrow is withdrawn. The arrows of the Macoushie tribe of Guiana (Fig. 94) are made with a small barbed and poisoned head, which is inserted in a socket in the shaft, in which it fits loosely, so as to detach in the wound. This weapon appears to form the link between the poisoned arrow and the fishing arrow or harpoon, which is widely distributed, and which I propose to describe on a subsequent occasion. Mr. Latham, of Wilkinson's, Pall Mall, has been kind enough to describe to me a Venetian dagger of glass, formerly in his possession; it had a tube in the centre for the poison, and the blade was constructed with three edges. By a sharp wrench from the assassin, the blade was broken off, and remained in the wound.

It has also been supposed that from their peculiar construction most of the triangular and concave-based arrow-heads of flint that are found in this country, and in Ireland, were constructed for a similar purpose (Fig. 95).

The serrated edges of weapons, like those of the bee and the sting-ray, when used as arrow-points, were likewise instrumental in retaining the poison and introducing it into the wound, and this form was copied with a similar object in some of the Florentine daggers above mentioned, a portion of the blade of one of which, taken from Meyrick's *Ancient Arms and Armour*, is shown in Fig. 96.[1]

Although the use of poison would in these days be scouted by all civilized nations as an instrument of war, we find it still applied to useful purposes in the destruction of the larger animals. The operation of whaling, which is attended with so much danger and difficulty, has of late been greatly facilitated by the use of a mixture of strychnine and 'woorali', the well-known poison of the Indians of South America. An ounce of this mixture, attached to a small explosive shell fired from a carbine, has been found to destroy a whale in less than eighteen minutes, without risk to the whaler.[2]

When we consider how impotent a creature the aboriginal and uninstructed man must have been, when contending with the large and powerful animals with which he was surrounded, we cannot too much admire that provision of nature which appears to have directed his attention, during the very earliest stages of his existence, to the acquirement of the subtile art of poisoning. In the forests of Guiana there are tribes, such as the Otomacs, apparently weaponless, but which, by simply poisoning the thumb-nail with 'curare' or 'woorali', at once become formidable antagonists.[1] Poison is available for hunting as well as for warlike purposes: the South American Indians eat the monkeys killed by this means, merely cutting out the part struck,[2] and the wild tribes of the Malay peninsula do not even trouble themselves to cut out the part before eating.[3] The Bushmen, and the Stiens of Cambodia, use their poisoned weapons chiefly against wild beasts and elephants.

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[1] Meyrick (Skelton), *Ancient Arms and Armour*, vol. ii. pl. cxiii, fig. 14, cf. fig. 13.

[2] *Times* newspaper, Dec. 24, 1866.

Thus we see that the most noxious of herbs and the most repulsive of reptiles have been the means ordained to instruct mankind in what, during the first ages of his existence, must have been the most useful of arts. We cannot now determine how far this agent may have been influential in exterminating those huge animals, the *Elephas primigenius* and *Rhinoceros tichorhinus*, with the remains of which the earliest races of man have been so frequently associated, and which, in those primaeval days, before he began to turn his hand to the destruction of his own species, must have constituted his most formidable enemies.

Missiles. Amongst the offensive weapons of animals, the use of missiles cannot be altogether excluded, although the examples of their use by the lower creation are extremely rare. Some species of cuttle-fish have the power of ejecting water with a good aim.[4] The Toxotes, or archer-fish, obtains its name from its faculty of projecting drops of water at insects some three or four feet from the surface of the water; which it seldom fails to bring down. The llama has a habit of ejecting its saliva, but I am not aware of the object of this singular practice. I only know from experience that its manners

[1] Humboldt, *Aspects of Nature* (London, 1849), vol. i. pp. 25, 203–4.

[2] Klemm, l. c., p. 53.

[3] 'On the Wild Tribes in the Interior of the Malay Peninsula,' by Père Bourien. *Trans. Ethno. Soc.*, N.S., vol. iii (1865), p. 78.

[4] Darwin, *Journal of Researches into Nat. Hist. and Geology* (London, 1845), p. 8.

are offensive, and that it has the power of spitting with a good aim and for some distance. The porcupine has the power of throwing its quills, and is said to do so with effect, although it is not now believed to dart them with any hostile intention. The Polar bear is described in Captain Hall's recent publication as an animal capable of capturing the walrus by missile force.[1] It is said that the bear will take advantage of an overhanging cliff, under which its prey is seen asleep upon the ice, to throw down, with its paws, large stones, and with such good aim as to hit the walrus on the head, after which, running down to the place where the animal lays stunned, it will take the stone to beat out its brains. That animals are instinctively acquainted with the force of gravitation is evident by their avoiding precipices that would endanger them, and it certainly requires a slight (but at the same time most important) advance upon this knowledge, to avail themselves of large stones for such purposes as are here attributed to the bear; but as the story only rests on the authority of the Esquimaux, it must, I think—although they certainly are careful observers of the habits of animals—be rejected, until confirmed by the direct testimony of white men. It has even been doubted whether the alleged habit of monkeys, in throwing coco-nuts at their pursuers, has not arisen from the mistake of the hunter in supposing that fruit accidentally detached from their stalks by the gambols of these animals in the trees, may have been intended as missiles; but it appears now to be clearly established that monkeys have the intelligence, not only to throw stones, but even to use them in breaking the shells of nuts. Major Denham, in his account of his travels in Central Africa, near Lake Tshad, says: 'The monkeys, or as the Arabs say, men enchanted, "Beny Adam meshood," were so numerous, that I saw upwards of 150 assembled in one place in the evening. They did not at all appear inclined to give up their ground, but perched on the top of a bank, some 20 feet high, made a terrible noise, and rather gently than otherwise, pelted us as we approached within a certain distance.' This, I think, is clear evidence of a combined pelting on the part of these untutored animals.

The monkey thus furnishes us with the only example of the use of any external substance for offensive purposes, by any member of the animal kingdom. All others, except, perhaps, the missile fishes above described, use, for offence and defence, the weapons with which nature has furnished them, and which are integral parts of their persons. It is this which so essentially distinguishes man from the lower creation. Man is the tool-using animal. We have no knowledge of man, in any state of existence, who is not so; nor have we (with the exception of the ape, the link indirectly connecting him with the lower creation, in the same manner that the savage connects the civilized with the aboriginal man, both being branches from the same stem) any knowledge of animals that employ tools or weapons. Herein lies the point of separation, which, in so far as the material universe is concerned, marks the dawn of a new dispensation. Hitherto Providence operates directly on the work to be performed, by means of the living, animated tool. Henceforth, it operates indirectly on the progress and development of creation, first, through the agency of the instinctively tool-using savage, and by degrees, of the intelligent and reasoning man.

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[1] Hall, C. F., *Life with the Esquimaux* (London, 1864), vol. ii. pp. 329–30.

DESCRIPTION OF PLATES VI–XI

[*Revised and abridged from the 'Description' appended to the original text. The roman numeral refers to the Plate on which the figure is printed.*]

1. *a.* Adze of iron, constructed by Captain Cook's armourer for the use of the natives of Tahiti. *b.* Adze of stone, Tahitian, used as model in making the above. Meyrick (Skelton), *Engraved Illustrations of Ancient Arms and Armour* (1830), vol. ii. pl. cxlix. PLATE VI.
2. *a.* Pipe-handled Tomahawk, of European manufacture, constructed for the use of North American Indians. (Mus. R. U. S. Inst.) Meyrick (Skelton), l. c., vol. ii. pl. cxlix. *b.* Pipe and Tomahawk of pipe-stone, used by the Dacotas of N. America. Schoolcraft, *Information concerning the History, &c., of the Indian Tribes of the United States*, vol. ii. pl. lxix. VI.
3. Maeotian, or Scythian Bow, from a vase-painting. Hamilton, *Etruscan Antiquities*, vol. iv. pl. cxvi; Meyrick, *Critical Enquiry into Ancient Armour* (1824), vol. i. pl. ii. 14; Rawlinson, *Herodotus* (1862), vol. iii. pp. 3, 35. VI.
4. Bow of the Tartar tribes on the borders of Persia. (Mus. R. U. S. Inst.) Meyrick (Skelton), l. c., vol. ii. pl. cxliv. VI.
5. Iron Sword (*minus* the wooden handle) and War-Axe of native manufacture, constructed by the Fans of the Gaboon country, West Africa. (Author's Collection; similar spec. in Mus. R. U. S. Inst.) The patterns of ornamentation are taken partly from the Fan War-Axe, and partly from iron knives brought from Central Africa by Mr. Petherick. (Author's Coll.) VI.

6. Leaf-shaped Bronze Sword (*minus* the handle), from Ireland (Author's Coll.); and a Bronze Celt (Mainz Mus.), Lindenschmit, *Die Alterthümer unserer heidnischen Vorzeit* (1864 ff.). The patterns of ornamentation are taken partly from Lindenschmit, l. c., pl. iii.; partly from Irish bronze-work in Sir W. Wilde, *Catalogue of the Museum of the Royal Irish Academy* (1863), Bronze, pp. 389–90. VI.

7. 'Manilla,' or ring-money of copper and iron, used in the Eboe country, W. Africa. (Author's Coll.) In 1836, a ship laden with a quantity of these 'manillas', made in Birmingham, after the pattern in use in Africa (the spec. here figured forming part of the cargo), was wrecked on the coast of co. Cork. By this means their exact resemblance to the gold and bronze 'penannular rings' found in Ireland (Fig. 8) attracted the attention of Mr. Sainthill, of Cork, by whom the subject was communicated to the *Ulster Journal of Archaeology*, No. 19 (July, 1857). VI.

8. 'Penannular Ring,' found in Ireland. Wilde, l. c., Bronze, p. 570, Gold, p. 53. Similar forms are found in England and on the Continent. Lindenschmit, pl. iv; Keller, *Lake Dwellings of Switzerland* (tr. Lee, 1866), pl. lii *a*, fig. 9. VI.

9. Kaffir Assegai-head of iron, of native manufacture, with section of blade. (Mus. R. U. S. Inst.) VI.

10. Saxon Spear-head of iron, having the same section as fig. 9; from a Saxon grave. Neville, *Saxon Obsequies* (London, 1852), pl. xxxv; Akerman, *Saxon Pagandom* (London, 1855), Introd., p. x. VI.

11. War-dress of a Patagonian Chief, composed of seven thicknesses of hide on the body part, and three on the sleeves. (Mus. R. U. S. Inst.) VII.

12. Section of the above, upon the breast, showing how the seven thicknesses are united at the top. VII.

13. Kayan Cuirass of untanned hide, with the hair outside; and Helmet of cane wickerwork. (Mus. R. U. S. Inst.; pres. by Capt. D. Bethune, R.N.) VII.

14. Egyptian Breast-plate, made of a crocodile's back. Meyrick (Skelton), l. c., vol. ii. pl. cxlviii. VII.

15. Suit of Armour, supposed to have formerly belonged to the Rajah of Guzerat. The four breast- and back-pieces are of rhinoceros hide, having an inscription upon them, beginning with an invocation to Ali. The remaining portions are of black velvet, ornamented with brass studs, and padded. Meyrick (Skelton), l. c., vol. ii. pl. cxli. VIII.

16. Four Plates of steel (Sikh), of similar form to those of rhinoceros hide in fig. 15, ornamented with patterns of inlaid gold. They are fastened with straps over a coat of chain-armour, and are called in Persian 'char aineh,' i.e. 'the four mirrors.' (Mus. R. U. S. Inst.) VIII.

17. Helmet of basket-work, from the Sandwich Islands, resembling the Grecian in form. (Mus. R. U. S. Inst.; presented by H. Shelley, Esq.) VIII.

18. Suit of Armour of coco-nut fibre, from Pleasant Island, in the Pacific. It is probable that the under tippet, which is now attached to the back- and breast-piece at the top, may originally have been intended to be worn round the loins, like a kilt. (Mus. R. U. S. Inst.) VII.

19. *a*. Quilted Pectoral of the Egyptians. Meyrick, l. c., vol. i. pl. i. *b*. shows the manner in which it was worn. Rawlinson, *Herodotus* (1862), vol. iv. p. 47, No. iii. 3 (but this figure is Kheta, not Egyptian.—Ed.). VII.

20. Quilted Head-dress of the Egyptian soldiers. Meyrick, l.c., vol. i. pl. i. VIII.

21. Quilted Helmet of nearly the same form as fig. 20, from India. (Author's Coll.) VIII.

22. Head-dress of nearly the same form as figs. 20, 21, from the Nouaer tribe of Negroes, inhabiting both banks of the Nile from 8° to 10° N. latitude; brought to England by Mr. Petherick. It resembles the Egyptian very closely, and is composed of cylindrical white beads of European manufacture, fastened together with a kind of string. (Author's Coll.) VIII.

23. Helmet of the same form as fig. 21, composed of united mail and plate, formerly belonging to the Body-guard of the Moguls. (Author's Coll.) VIII.

24. Suit of Quilted Armour, taken in action from Koer Singh, the famous Rajpoot Chief, of Jugdespore in Behar, on August 12, 1857, by Major Vincent Eyre, commanding the field force that relieved Arrah. (Mus. R. U. S. Inst.; presented by the captor.) VII.

25. *a.* Suit of Quilted Armour, found upon the body of Tippoo Sahib at his death, in the breach of Seringapatam. (Mus. R. U. S. Inst.) IX.
   b. Portion of one of the nine thicknesses of quilting, of the above, showing construction (see p. 62) : reduced to ⅙. IX.
   c. Helmet of the above suit. (Mus. R. U. S. Inst.) IX.

26. Quilted Armour of the Bornouese Cavalry. Denham and Clapperton, *Travels in Northern and Central Africa* (1826), p. 328 (Denham). VIII.

27. Suit of Armour from the Navigator Islands, composed of coco-nut fibre, coarsely netted. (Mus. R. U. S. Inst.; presented by Sir W. Burnett, M.D.) Similar armour is used in the Kingsmill Group. VII.

28. Part of a Chinese 'Brigandine Jacket' of cotton, quilted, with enclosed plates of metal. (Mus. R. U. S. Inst.) VII.

29. Head-dress of Hercules wearing the Lion's Skin, from a Bronze in the Blacas Collection. (British Museum.) VIII.

30. Head-dress of a North American Chief. Schoolcraft, l. c., vol. iii. p. 68, pl. x. 2. VIII.

31. Thracian Helmet of brass [?], with horns of the same. Meyrick, l. c., vol. i. pl. iii. VIII.

32. Ancient British Helmet of bronze, with straight horns of the same, found in the Thames. (British Museum.) VIII.

33. Greek Helmet, having horns of brass [?]. Meyrick, l. c., vol. i. pl. iv. VIII.

34. Back-plate and Breast-plate of the Bugo Dyaks, armed with the scales of the Pangolin. (Mus. R. U. S. Inst.) IX.

35. Piece of Bark from Tahiti, studded with pieces of coco-nut shell. (Mus. R. U. S. Inst.) VIII.

36. Fragment of Scale-Armour of horn found at Pompeii. [*Pictorial Gallery of Arts*, vol. i. figs. 10, 61.] VIII.

37. Piece of Scale-Armour, made of the hoofs of some animal, from some part of Asia; said to be from Japan. Meyrick, l.c., vol. i. pl. iii. VIII.

38. An ancient Stone Figure in Scale Armour. Cuming, *Journ. Archaeol. Assoc.*, vol. iii. p. 31. IX.

39. Back-piece and Breast-piece of Armour from the Sandwich Islands, composed of seals' teeth. (Mus. R. U. S. Inst.; pres. by H. Shelley, Esq.) VIII.

40. Egyptian Suit of Scale-Armour. Rawlinson, *Herodotus* (1862), vol. ii. p. 65, fig. iii; Wilkinson (Birch), *Manners and Customs of the Ancient Egyptians* (1878), fig. 53 *a.* IX.

41. Two Scales of Egyptian Armour, enlarged. Rawlinson, l. c., fig. iv. IX.

42. Japanese Armour, composed of chain, plate, and enclosed quilted plates. (*a*) Left arm; (*b*) Greaves. (Author's Coll.) IX.

43. *a.* Chinese Suit of Armour, of cotton, having iron scales attached to the inside. *b.* Iron Helmet of the same suit. (Mus. R. U. S. Inst.; presented by Capt. Sir E. Belcher, R.N.) IX.

44. A portion of the iron scales attached to the inner side of the above suit. IX.

45. Breast-piece of 'Jazerine' Armour of iron scales, xv–xvi cent.; inner side. (Author's Coll.) Cf. Grose, *Treatise on Ancient Armour* (London, 1786), p. 15, 'Jazerant'; cf. pl. xxxiii. 3; Meyrick, vol. ii. pl. lvi. IX.

46. 'Brigandine' composed of large iron scales on the outside, probably of the same date as the above; left by the Venetians in the armoury of Candia on the surrender of the island to the Turks in 1715. (Mus. R. U. S. Inst.; presented by Lt.-Col. Patrick Campbell, R.A.) IX.

47. Horn of the Rhinoceros. (Author's Coll.) X.

48. Skull and Tusks of the Walrus. (Author's Coll.) X.

49. Weapon of the Sword-Fish; scale ¼ inch to a foot. (Author's Coll.) X.

50. Spear of the Narwhal; scale ⅓ inch to a foot. (Author's Coll.) X.

51. Section, showing part of the timber of the ship *Fame*, where it was pierced by the narwhal in the South Seas, through 2½-inch oak. (Mus. R. U. S. Inst.; presented by Lt. A. T. Tulloch, R.A.) X.
52. Esquimaux Spear, from Greenland, armed with the spear of the narwhal. $\frac{1}{20}$. (Mus. R. U. S. Inst.) X.
53. Esquimaux Spear in the form of a fish, having fore-shaft composed of a narwhal-tusk, inserted so as to represent the tusk of the animal; scale ¼ inch to a foot. (Author's Coll.) X.
54. Esquimaux Lance, pointed with a walrus-tooth. $\frac{1}{20}$. (Mus. R. U. S. Inst.) X.
55. Esquimaux Tomahawk or Pickaxe, headed with a walrus-tooth. $\frac{1}{20}$. (Mus. R. U. S. Inst.) X.
56. Arrow-head, probably from South America, headed with the point of a deer's horn. (British Museum, Christy Collection.) X.
57. War-club of the Iroquois, called *Ga-ne-ú-ga-o-dus-ha* or 'Deer-horn War-Club.' Lewis Morgan, *League of the Iroquois* (Rochester, N.Y., 1851), p. 363. X.
58. Club of the North American Indians, with a point of iron. $\frac{1}{20}$. (Mus. R. U. S. Inst.; presented by T. Hoblyn, Esq.) X.
59. Arrow, from S. America, armed with the weapon of the ray, probably *Trygon hystrix*. ¼. (Mus. R. U. S. Inst.) X.
60. *a.* Spine of *Balistes capriscus*, *Cuv.*, erect. Yarrell, *British Fishes* (2nd ed., London, 1841), vol. ii, p. 472. *b.* Horn of *Cottus diceraus*, *Pall.* Cuvier, *Animal Kingdom* (1827), s.v. *c.* Horn of *Naseus fronticornis*, *Lac.* Cuvier, l.c. X.
61. Spear of the *Limulus* or 'King Crab.' X.
62. Arrow, armed with the spine of the *Diodon*. ¼. (Author's Coll.) X.
63. 'Khandjar' or Indian Dagger, composed of the horn of the buffalo, having the natural form and point. $\frac{1}{10}$. (Author's Coll.) X.
64. 'Khandjar' of the same form, with metal blade and ivory handle. $\frac{1}{16}$. (Author's Coll.) X.
65. 'Khandjar' of the same form, having both blade and handle of iron. The handle is ornamented with the figures of a bird and some small quadruped. $\frac{1}{10}$. (Author's Coll.) X.
66. Dagger formed of the horn of the 'sasin,' or common antelope. $\frac{1}{10}$. (Author's Coll.) X.
67. Dagger like fig. 66, but with the points armed with metal. $\frac{1}{10}$. (Mus. R. U. S. Inst.) X.
68. Dagger like figs. 66, 67, but composed entirely of metal, with a shield for the hand. Similar shields are sometimes attached to daggers like those in figs. 66, 67. $\frac{1}{12}$. (Mus. R. U. S. Inst.) X.
69. Weapon composed of the horn of the antelope; steel-pointed; supposed to be that used by the Fakirs in India. (Author's Coll.) X.
70. Sword formed of the serrated blade of the saw-fish from New Guinea. (Mus. R. U. S. Inst.) XI.
71–74. Weapons from the Pacific, edged with sharks' teeth. The teeth near the point are placed points forward; the remainder with the points towards the handle. Two methods of fastening the teeth are shown: *a.* in grooves; *b.* lashed between two strips of wood. (Mus. R. U. S. Inst.) XI.
75. Implement from New Zealand, armed with sharks' teeth. (British Museum.) XI.
76. Esquimaux Knife, from Davis Strait, armed with pieces of meteoric iron. (British Museum.) XI.
77. Knife, from Greenland, armed with pieces of iron along the edge. (British Museum, Christy Collection.) XI.
78–80. Mexican 'Maquahuitl.' Lord Kingsborough, *Antiquities of Mexico* (1830–48), vol. i (numerous examples on pl. x–xv: fig. 79 = No. 1478). XI.
81–82. Spear and Knife, from Australia, armed with pieces of obsidian, or rock-crystal. (Mus. R. U. S. Inst.) XI.
83. Arrow-point of bone, armed with a row of sharp flint flakes on each side. (Museum of Prof. Nilsson, at Lund, in Sweden.) Reduced to ½ from the figure in Wilde, l. c., 'Animal Materials,' p. 254. XI.

84. Arrow-point like fig. 83. (Copenhagen Museum.) *Illustr. Cat. of the Copenhagen Museum.* XI.

85. Arrow-point of hollow bone, from S. America, the hollow of the bone being filled with poison. (Mus. R. U. S. Inst.; Author's Coll.) XI.

86. Dagger of an Italian Bravo, with grooves and holes to contain poison; the handle represents a monk in the act of supplication. (Author's Coll.) XI.

87 *a*. Scottish Dirk, pierced with holes along the back and sides. Along the back of the blade runs a groove eight inches long, in which holes are pierced that communicate with lateral holes on the side of the blade. (Author's Coll.) XI.

87 *b*. 'Couteau-de-Chasse,' with two grooves on each side near the back of the blade, which is pierced through with holes. (Author's Coll.) XI.

88. Arrow-head, of iron, with a hole near the point for poison; from S. America. (Author's Coll.) XI.

89. Sting of the Bee, serrated or multi-barbed: after F. Huber in *Jardine's Naturalist's Library*, Entomology vi. *Bees* (Edinb., 1840), p. 40. XI.

90. Point of Bushman's Arrow, barbed with an iron head, which is constructed to come off in the wound. (Author's Coll.) XI.

91. Malay Blowpipe-arrow, iron-headed; similarly constructed. ¼. (Author's Coll.) XI.

92. Arrow of the wild tribes of Assam, copper-headed, and similarly constructed. ¼. (Author's Coll.) XI.

93. Arrow-head of the Shoshones of North America, of flint; constructed to come off in the wound. Schoolcraft, l. c., vol. i. pp. 212–3, pl. lxxvi. 5. XI.

94. Arrow-point of the Macoushie Indians of S. America; similarly constructed. ¼. (Author's Coll.; pres. by Rev. J. G. Wood.) XI.

95. Arrow-heads of flint, from the north of Ireland. ¼. (Author's Coll.) XI.

96. Part of the Blade of an Italian Dagger, serrated and pierced. Full size. Meyrick (Skelton), l. c., vol. ii. pl. cxiii. 14. XI.

[*Journ. R. U. S. Inst.*, XI. Pl. xlviii.] **PLATE VI.**

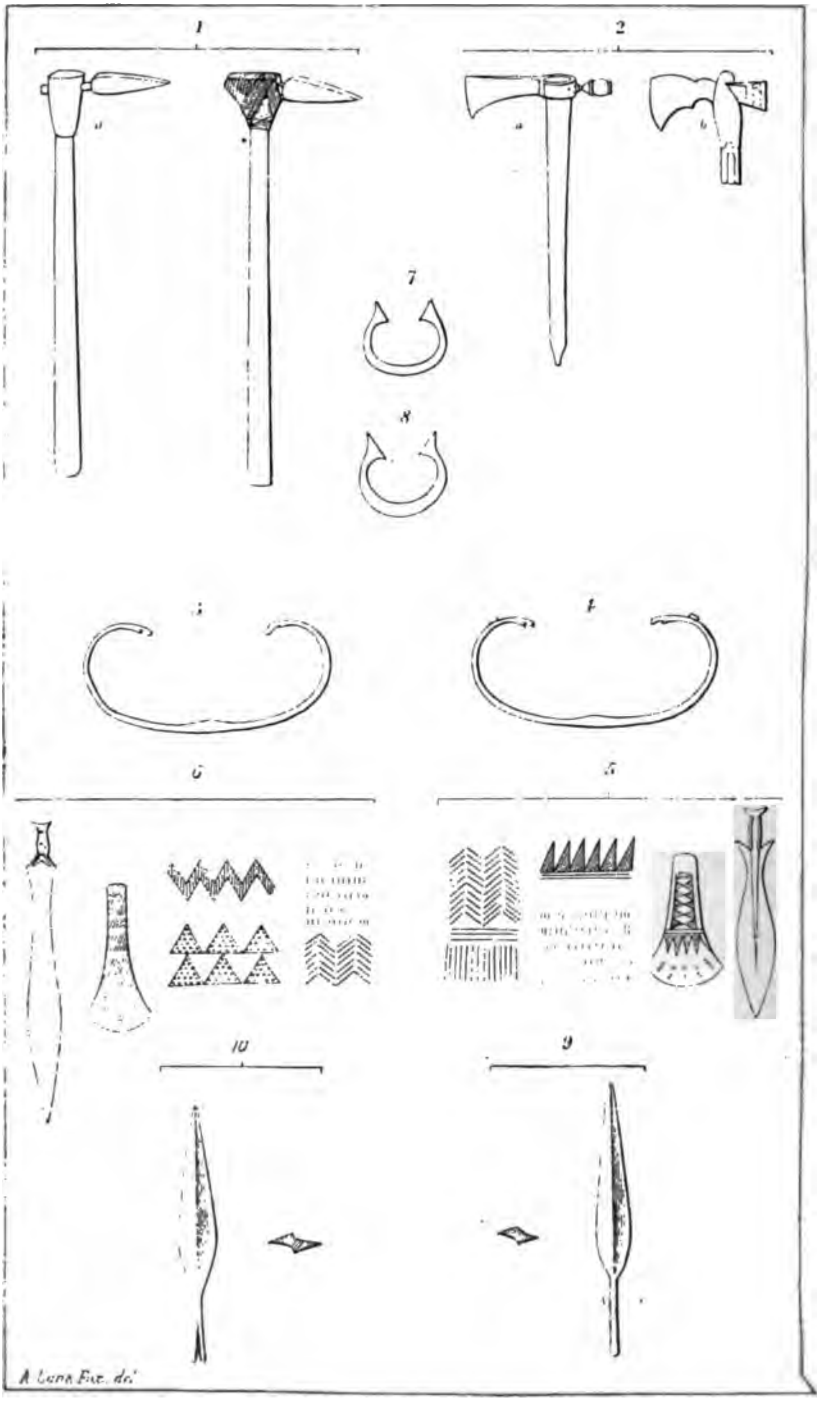


PLATE VIII.

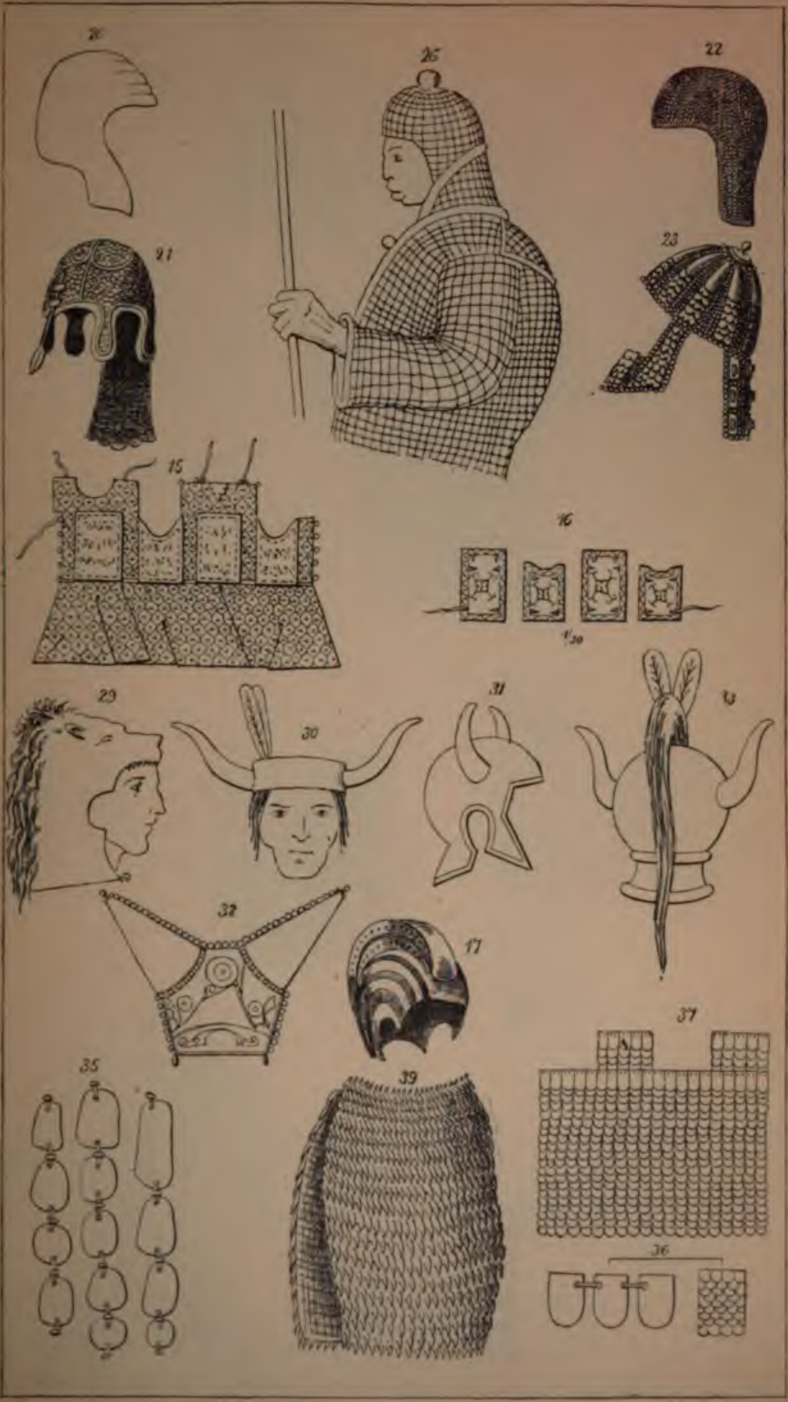
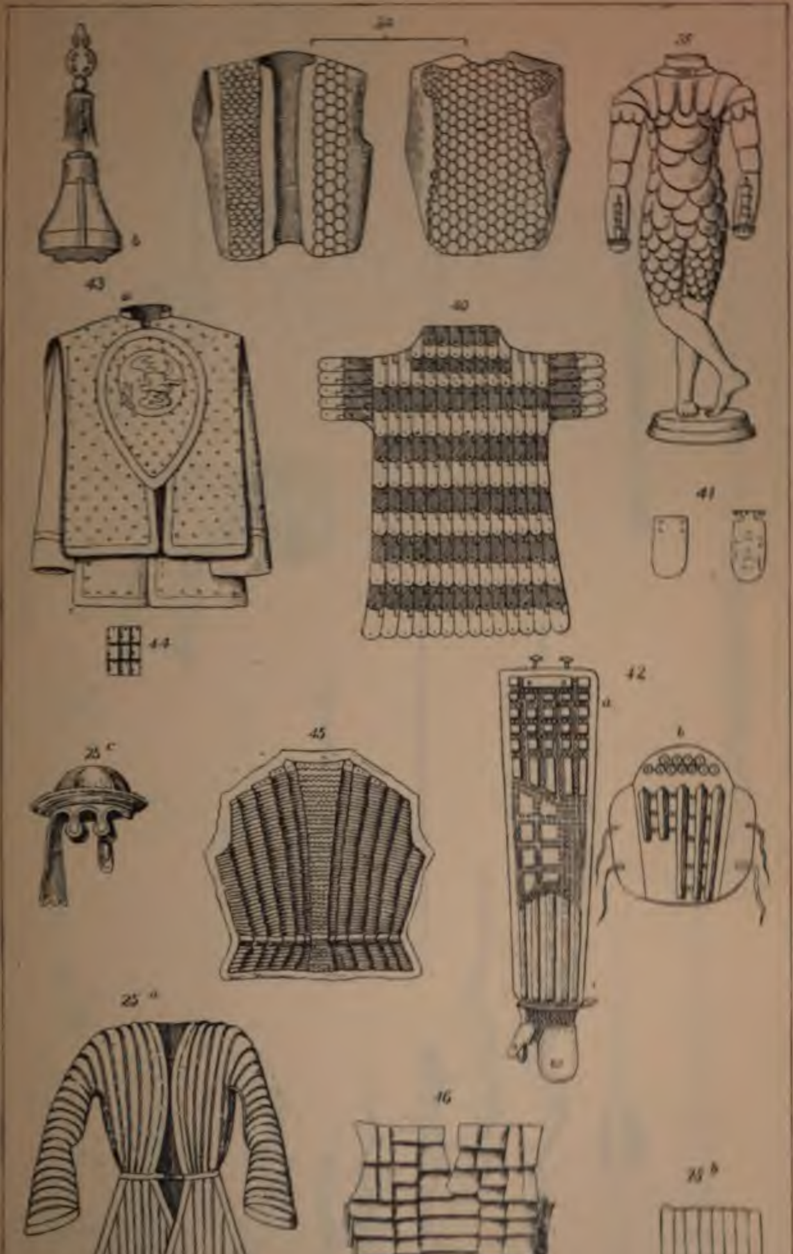


Plate IX.



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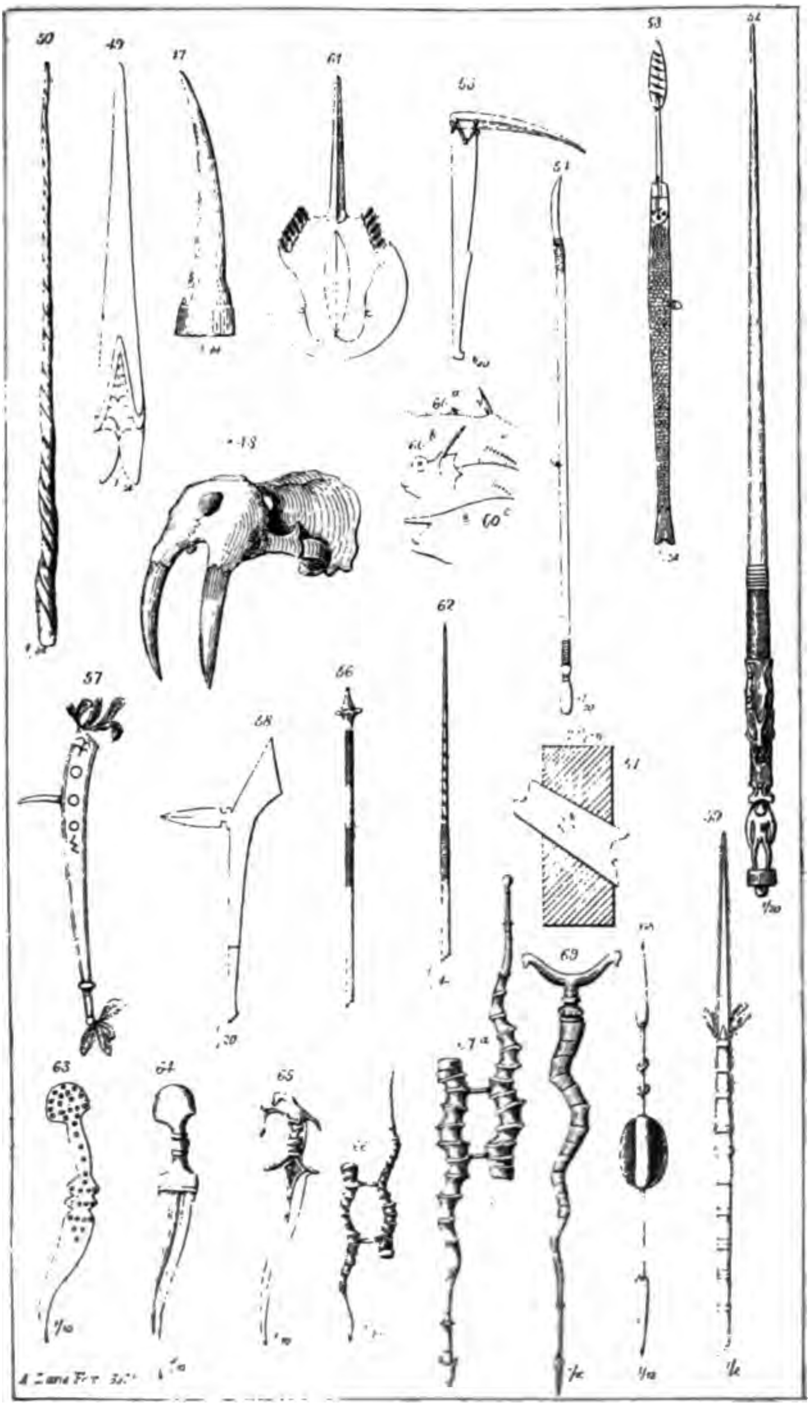
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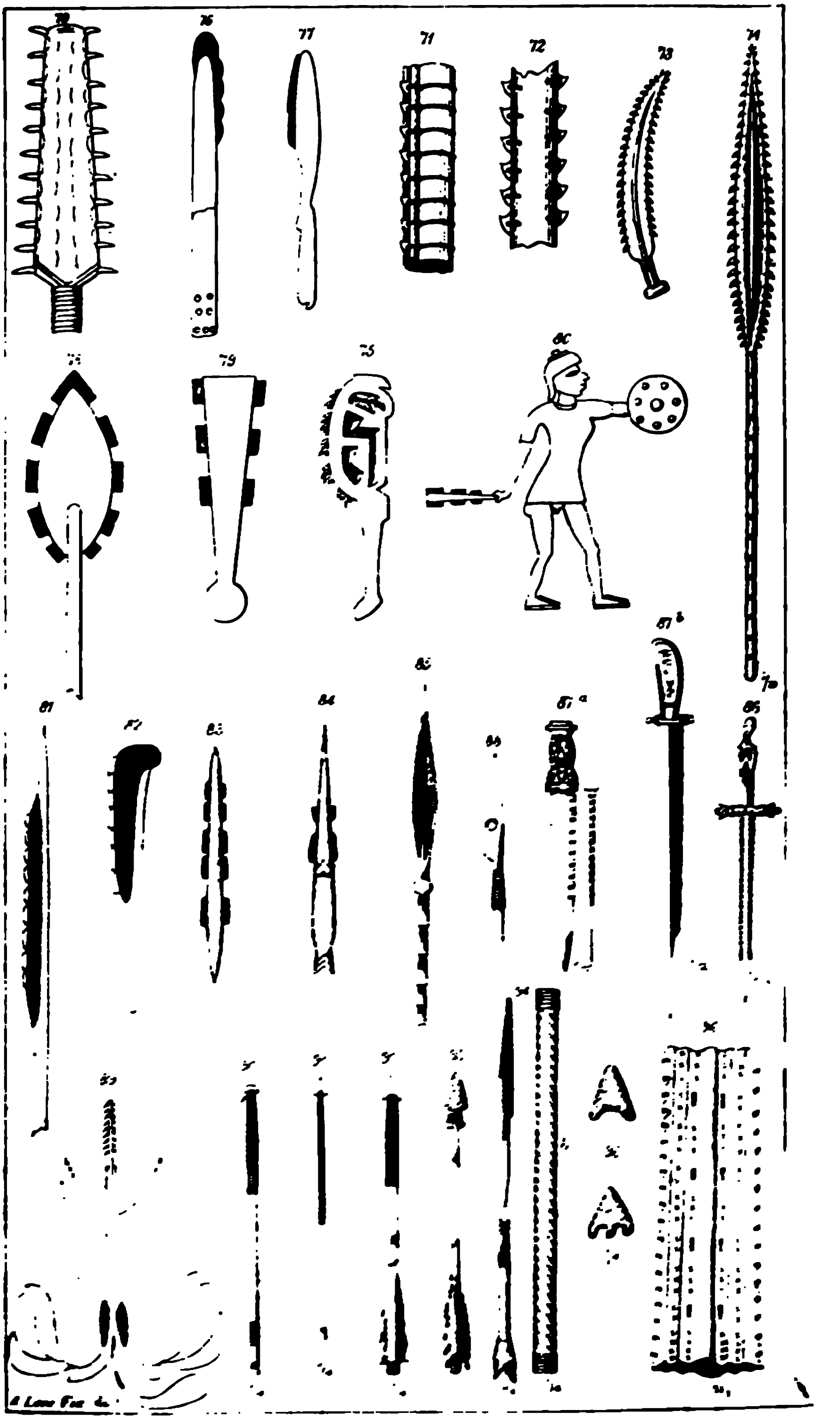
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PRIMITIVE WARFARE

II

ON THE RESEMBLANCE OF THE WEAPONS OF EARLY MAN, THEIR VARIATION, CONTINUITY, AND DEVELOPMENT OF FORM.[1]

General Remarks.

In June, 1867, I had the honour of reading a paper at this Institution, which has since been published in the *Journal*, the object of which was to point out the resemblance which exists between the weapons of savages and early races and the weapons with which nature has furnished animals for their defence.

In continuation of the same subject, my present communication will relate to the resemblance to each other of the weapons of races sometimes widely separated, and of which the connexion, if it ever existed, has long since been consigned to obscurity. I shall endeavour to show, how in these several localities, which are so remote from one another, the progress of form has been developed upon a similar plan, and, though to all appearance independently, yet that under like conditions like results have been produced; and that the weapons and implements of these races will sometimes be found to bear so close a resemblance to each other, as often to suggest a community of origin, where no such common origin can have existed, unless at the very remotest period.

We shall thus be brought to the consideration of the great problem of our day, viz. the origin of mankind, or rather the origin of the human arts; for the question of man's origin, whether he was himself created or developed from some prior form, whether since the period of his first appearance he has by variation separated into distinct races, or whether the several races of mankind were separately created, are questions which, however closely allied, do not of necessity form part of our present subject. It has to deal solely with the origin of the arts, and more particularly with the art of war, which in the infancy of society belonged to a condition of life so constant and universal as to embrace within its sphere all other arts, or at least to be so intimately connected with them as to require the same treatment; the tool and the weapon being, as I shall presently show, often identical in the hands of the primaeval savage.

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[1] A Lecture delivered at the Royal United Service Institution on June 5, 1868, and printed in the *Journal of the R. U. S. Inst.*, vol. xii (1868), pp. 399–439, pl. xvii–xxi (= Plates XII–XVI herewith).

These prefatory remarks are necessary because it will be seen that the general observations I am about to offer on the subject are fully as applicable to the whole range of the industrial arts of mankind as to the art of war. My illustrations, however, will be taken exclusively from weapons of war.

Is not the world at the present time, and has it not always been, the scene of a continuous progress? Have not the arts grown up from an obscure origin, and is not this growth continuing to the present day?

This is the question which lies at the very threshold of our subject, and we must endeavour to treat it by the light of evidence alone, apart from all considerations of a traditional or poetic character.

I do not propose here to enter into a disquisition upon the functions of the human mind. But it must I think be admitted, that if man possessed from the first the same nature that belongs to him at the present time, he must at the commencement of his career in this world have been destitute of all creative power. The mind has never been endowed with any creative faculty. The only powers we possess are those of digesting, adapting, and applying, by the intellectual faculties, the experience acquired through the medium of the senses. We come into the world helpless and speechless, possessing only in common with the brutes such instincts as are necessary for the bare sustenance of life under the most facile conditions; all that follows afterwards is dependent purely on experience.

Whether we afterwards become barbarous or civilized, whether we follow a hunting, nomadic, or agricultural life, whether we embrace this religion or that, or attain proficiency in any of the arts, all this is dependent purely on the accident of our birth, which places us in a position to build upon the experience of our ancestors, adding to it the experience acquired by ourselves. For although it is doubtless true that the breeds of mankind, like the breeds of our domestic animals, by continual cultivation during many generations, have improved, and that by this means races have been produced capable of being educated to a higher degree than those which have remained uncivilized, this does not alter the fact that it is by experience alone, conscious or unconscious, self-imposed or compulsory, and by a process of slow and laborious induction, that we arrive at the degree of perfection to which, according to our opportunities and our relative endowments, we ultimately attain.

The amount, therefore, which any one individual or any one generation is capable of adding to the civilization of their age must be immeasurably small, in comparison with what they derive from it.

I could not perhaps appeal to an audience more capable of appreciating the truth of these remarks than to the members of an Institution, the object of which is to examine into the improvements and so-called inventions which are from time to time effected in the machinery and implements of war.

How often does any proposal or improvement come before this Institution which after investigating its antecedents is found to possess originality of design? Is it not a fact that even the most ingenious and successful inventions turn out on inquiry to be mere adaptations of contrivances already existing, or that they are produced by applying to one branch of industry the principles or the contrivances which have been evolved in another. I think that no one can have constantly attended the lectures of this or any similar Institution, without becoming impressed, above all things, with the want of originality observable amongst men, and with the great calls which, even in this age of cultivated intellects and abundant materials to work upon, all inventors are obliged to make upon those who have preceded them.

Since, then, we ourselves are so entirely creatures of education, and derive so little from our own unaided resources, it follows that the first created man, if similarly constituted, having no antecedents from which to derive instruction, could not, without external aid, have made any material or rapid advance towards the initiation of the arts.

So fully has the truth of this been recognized by those who are not themselves advocates for the theory of development, that in order to account for the very first stages of human progress they have found it necessary to assume the hypothesis of supernatural agency: such we know was the belief of the classical pagan nations, who attributed the origin of many of the arts to their gods; such we know to be the tradition of many savage and semi-civilized nations of modern times that have attained to the first stages of culture. But we have already disposed of this hypothesis at the commencement of these remarks, by deciding that our arguments should be based solely upon evidence. We are, therefore, under the necessity of assuming, in the absence of any evidence to the contrary, that none but the agencies which help us now were at the disposal of our first ancestors, and the alternative to which we must have recourse is that of supposing that the progress of those days was immeasurably slower than it is at present, and that vast ages must have elapsed after the first appearance of man before he began to show even the first indications of a settled advance.

Yet the complex civilization of our own time has been built on the foundations that were laid by these aborigines of our species, while the brute creation may be said to have produced little more than was necessary to their own wants or those of their immediate offspring. Man has been the agent employed in a work of continuous progression. Generation has succeeded generation, and race has succeeded race, each contributing its quota to the fabrication of the edifice, and then giving place to other workmen. But the progress of the edifice itself has never ceased; it has gone on, I maintain (contrary to the opinion of some writers of our day), always in fulfilment of one vast design. It is a work of all time.

To study it comprehensively, we must devote ourselves to the contemplation of the edifice itself, and set aside the study of mankind for separate treatment, for it is evident that man has been fashioned, not as the designer, but simply as the unconscious instrument of its erection. Each individual has been impelled by what—viewed in this light—may be regarded as instincts sufficient to stimulate him to labour, but falling immeasurably short of a comprehensive knowledge of the great scheme, towards which he is an unconscious contributor. Of this he knows no more than the earthworm knows it to be its function to cover the crust of the earth with mould, or the small coral polypus knows that it is engaged in the erection of a barrier reef. No comprehensive scheme of progress need be searched for in the pigmy intellect of man, and if we are ever destined to acquire any knowledge of the laws which influence the growth of civilization, we must look for them in an investigation of the phenomenon itself, by studying its phases and the sequence of its mutations. In short we must apply to the whole range of human culture, to the arts, whether of peace or war, the same method which has already been applied with some success to the history of language.

It has been shown that the speech of our own day has been the work of many generations and of innumerable distinct races; its roots are traceable in the utterances of the untutored savage. No nation ever consciously invented a grammar, and yet language has been shown to be capable of being treated as a science of natural growth, having its laws of mutation and development, never dreamt of by any of the many myriads of individuals that have unconsciously contributed to the formation of it. May not all the products of human intellects in the aggregate be made amenable to the same treatment, and, like language, be found to be influenced by laws of evolution and progress?

That these remarks are not merely speculative, that the progress of civilization has been continuous and connected, while the races which have been engaged in the formation of it, like individuals, have had their periods of birth, maturity, and decay, is sufficiently proved by history.

In Egypt and in Assyria, we see the remains of ancient and formerly populous cities, where now the nomadic Arab pitches his tent or wanders with his flocks, thus showing that relapses of civilization must have occurred in those particular localities where such phenomena are observed. But we know also from history that the civilization which once flourished in those countries did not expire there, but was transferred thence to other places; that the culture of Assyria and of Egypt passed into Greece and developed there; that from Greece it extended to Rome, and in the hands of a new people passed through fresh phases; that after the destruction of the Roman Empire it lay dormant for many ages, only to rise again on its original basis, extended and fertilized by the introduction of fresh blood; that we ourselves are the inheritors of the same arts, customs, and institutions, modified and improved; and finally, that civilization, expanding in all directions, as it continues to move westward, is now in process of being received back by those ancient countries in which it originated, in a condition far more varied and diversified than it could ever have become, had it been confined to a single people or country.

Passing now from the known to the unknown, we come to the study of prehistoric times, prepared to find that every fresh discovery helps us to trace backwards the arts of mankind in unbroken continuity towards their source.

Commencing with the Saxon and the Celt, and passing from these to the lake dwellers, and on to the inhabitants of caves, races whose successive periods of existence are determined chiefly by the animals with which their remains are associated, we find that, according to their antiquity, they appear to have lived in a lower and lower condition of culture, until in the drift period, coeval with the extinct mammoth and the woolly haired rhinoceros, we find the earliest traces of man, scanty and unsatisfactory though they be, yet sufficient to show that he must have existed in a state so rude, as to have devised no better implements than flints pointed at one end, and held in the hand.

These successive prehistoric stages of civilization have been divided into the stone, the bronze, and the iron ages of mankind. The evidence upon which this classification is based, has been so ably set forth in the works of Sir John Lubbock and others, that I need not refer to it further than to state that, in my treatment of the origin and development of the weapons of war, I shall in a great measure follow the same arrangement. But I shall endeavour to trace the development of *form* rather than the *material* of weapons, and to show by examples taken from various distinct periods, and especially by illustrations taken from existing savages, the various agencies which appear to have operated in causing progression during the earliest ages of mankind.

Of these, the first to be considered is undoubtedly the utilization and imitation of natural forms. Nature was the only instructor of primaeval man.

In my previous paper, I discussed this subject at some length, giving many examples in which the weapons of animals have been employed by man. But besides these weapons derived from animals, primaeval man must no doubt at first have employed the natural forms of wood and bone, and of stones either fractured by the frost, or rolled into convenient forms upon the seashore.

This principle of the utilization and imitation of natural forms appears to bear precisely the same relationship to the development of the arts, that, in the science of language, onomatopoeia has been shown to bear to the growth and development of articulate speech. In the attempt to trace language to its origin, onomatopoeia, or the imitation of the sounds of animals and of nature, appears not only to have been the chief agent in *initiating* the growth of language, but it has also served to enrich it from time to time, so that even to this day, poetry and eloquence in a great measure depend on the employment of it. But apart from this, language has had an independent and systematic growth of its own.

So, in like manner, men not only drew upon nature for their ideas in the infancy of the arts, but we continue to copy the forms and contrivances of nature with advantage to this day. But apart from this, we must look for an independent origin and growth, in which form succeeded form in regular continuity. Many a lesson has still to be learnt from the book of nature, the pages of which are sealed to us until, by the natural growth of knowledge, we acquire the power of reading and applying them. Imitation therefore, though an important element in the initiation of the arts, would not alone be sufficient to account for the phenomenon of progress.

The next principle which we shall have to consider, is that of variation. Amongst all the products of the most primitive races of man, we find endless variations in the forms of their implements, all of the most trivial character. A Sheffield manufacturer informed me, that he had lately received a wooden model of a dagger-blade from Mogadore, made by an Arab, who desired to have one of steel made exactly like it. Accordingly my informant, thinking that he had found a convenient market for the sale of such weapons, constructed some hundreds of blades of exactly the same pattern. On arriving at their destination, however, they were found to be unsaleable.

Although precisely of the type in general use about Mogadore, all of which to the European eye would be considered alike, their uniformity rendered them unsuited to the requirements of the inhabitants, each of whom piqued himself upon possessing his own particular pattern, the peculiarity of which consisted in having some almost imperceptible difference in the curve or breadth of the blade.

In the earliest stages of art, men would of necessity be led to the adoption of such varieties by the constantly differing forms of the materials in which they worked. The uncertain fractures of flint, the various curves of the trees out of which they constructed their clubs, and the different forms of bones, would lead them imperceptibly towards the adoption of fresh tools. Occasionally some form would be hit upon, which in the hands of its employer would be found more convenient for use, and which, by giving the possessor of it some advantage over his neighbours, would commend itself to general adoption. Thus by a process, resembling what Mr. Darwin, in his late work, has termed 'unconscious selection', rather than by premeditation or design, men would be led on to improvement. By degrees some forms would be found best adapted to one pursuit, and some to another; one would be used for grubbing up roots, another for breaking shells, another for breaking heads; modes of procedure, accidentally hit upon in one class of occupation, would suggest improvements in another, and thus analogy, coming to the aid of accidental variation, would give an impulse to progress. Thus would commence that ramification of the arts, occupations, and sciences which, developing simultaneously and assisting each other, has borne fruit in the civilization of our own times.

I am aware that it will be found extremely difficult to realize a condition of human existence so low as that which I am supposing, and that many persons will deny the possibility of mankind having ever existed in a condition so helpless as to have been incapable of designing the simple weapons which we find in the hands of savages at the present day. It is as difficult to place one's self in the position of a being infinitely one's inferior, as of a being greatly one's superior in intellect. 'Few persons,' says Professor Max Müller, 'understand children, still fewer antiquity.' Our own experience cannot save us in estimating the powers of either, for, long before the period of which we have the earliest recollection, we had ourselves undergone a course of unconscious education in the arts of a civilized community; our very first utterances were in a language which was in itself the complex growth of ages, and the improvement of our natural faculties, resulting from the continued cultivation of our race, enhances the difficulty we find in appreciating the condition of our first parents.

Another fertile source of variation arises from errors in successive copies. At a time when men had no measures or other appliances to assist them in copying correctly, and were guided only by the eye, an implement would soon be made to assume a very different appearance. Mr. Evans has shown in his work on the 'Coins of the Ancient Britons' (p. 167) how the head of Medusa, copied originally from a Greek coin, was made to pass through a series of apparently meaningless hieroglyphics, in which the original head was quite lost, and was ultimately converted into a chariot and four. We must not, however, attribute all variation to this cause, for I quite agree with a remark made by Mr. Rawlinson in his 'Five Great Monarchies', that such varieties are more frequently noticed in cases where the contrivance is of home growth, than in those which are derived from strangers.

The third point which we shall have to consider in relation to continuity, is the retarding element. Under this head, incapacity must at all times, and especially in the infancy of society, have played the chief part. But as civilization progressed, other agencies would come in to influence the same result; prejudice, force of habit, principles of conservatism in which we have been told by Mr. Mill that all the dull intellects of the world habitually ensconce themselves, a thousand interests of a retarding tendency, rise up at the same time as those having a progressive influence, and prevent our advancing by other than well-measured paces.

The resultant of these contending forces is continuity. If we could but put together the missing links; if we could revive contrivances that have died at their birth, and expose piracies; if we could penetrate the haze that is so often thrown over continuity by great names, absorbing to themselves the credit of contrivances that belong to others, and thereby causing it to appear that progress has advanced with great strides, where creeping was in reality the order of the day; we should find that there is not a single work of man's hand which has not its history of slow and continuous development, capable of being traced back, like branches of a tree, to its junction with others, and so on until the roots of all are found to lie in the simplest contrivances of primaeval man.

But we must not expect that we shall be able, in the existing state of knowledge, to trace this continuity from first to last, for the links that are lost far exceed in number those which remain. The task may be compared to that of putting together the fragments of a tree that has been cut up for firewood, and of which the greater part has been burnt. It is only here and there, after diligent search, that we may expect to find a few pieces fitting in such a manner as to prove that they belonged to the same branch. We do not, on that account, abandon our conviction that the tree once grew, that every large branch was once a small twig, and that every limb developed by a natural process into the form in which we find it. The difficulty we have to contend with is precisely that which the geologist experiences in tracing his palaeontological sequence. But it is far greater, for natural history has been long studied, and the materials upon which Mr. Darwin founds his celebrated hypothesis have been in process of collection for many generations. But continuity, in relation to the arts, can scarcely yet be said to be established as a science. The materials for the science have not yet been even classified, and classification is a process which must always precede continuity in the study of nature. Classification defines the margin of our ignorance; continuity results from the extension of knowledge, by bridging over the distinction of classes. Travellers, for the most part, have been in the habit of bringing home, as curiosities, the most remarkable specimens of weapons and implements, without much regard to their history or the evidence they convey; and their descriptions of them, as a general rule, have been extremely meagre. Until quite recently, the curators of our ethnographical museums have aimed more at the collection of unique specimens, serving to exhibit well-marked differences of form, than such as by their resemblance enable us to trace out community of origin. The arrangement of them has been almost universally bad, and has been calculated rather to display the several articles to advantage, on the principle of shop windows, than to facilitate the deductions of science. The antiquities of savage races, moreover, have as yet been almost wholly unstudied.

Notwithstanding these difficulties, we are able to catch glimpses of evidence, here and there, which, when put together systematically, and when the vestiges of antiquity are illustrated by the implements of existing savages, will, I trust, be found sufficient to warrant the principles for which I contend.

Combination of Tool and Weapon.

In the earliest ages of mankind, when all men were warriors, and before the division of labour, consequent on civilization, had separated the arts of peace and war into distinct professions, we must expect to find the same implement frequently employed in the capacity of both tool and weapon. Even long after the very earliest ages of which we have any historical or archaeological record, we often find a combination of tool and weapon in the same forms, especially amongst those semi-civilized and savage races of our own times, whom we regard as the representatives of antiquity. The battles of liberty, from the age of the Jews and Philistines down to the time of the last Hungarian revolution, have always been fought by the subject people with weapons made out of the implements of husbandry. We read in the first of Samuel, chapter xiii, 'Now there was no smith found in all the land of Israel: for the Philistines said, Lest the Hebrews make them swords or spears: but all the Israelites went down to the Philistines, to sharpen every man his share' (the blade of the ploughshare), 'and his coulter' (a kind of knife), 'and his ax, and his mattock' (a kind of pickaxe). . . . 'So it came to pass, in the day of battle, that there was neither sword nor spear found in the hand of any of the people that were with Saul and Jonathan.' In the revolts of the German peasantry, in the fifteenth and sixteenth centuries, the bands of insurgents armed themselves with threshing flails and scythe blades. In 1794 and 1831, the Polish peasantry were similarly armed[1]; and it was from such implements of husbandry that weapons like the military flail, the bill, and the yataghan, derived their origin. In the recent outbreak in Jamaica (which, had it not been ably and powerfully put down, would have led to the destruction of the whole white population) the negroes armed themselves with weapons of husbandry. In the proclamation of Paul Bogle, he says: 'Every one of you must leave your house, take your guns; who don't have guns, take cutlasses.' The cutlasses here referred to were the implements used for cutting the sugar-cane, sharp on the concave edge, and are the same which, having been used as weapons by the negroes in their own country, have continued to be employed by them ever since. In like manner, we learn from Symes's 'Embassy to Ava in 1795',[1] that the Burmese use the sabre both for warlike purposes, as well as for cutting bamboos, felling timber, &c.; it is the constant companion of the inhabitants for all purposes, and they never travel without it. In Borneo, the peculiar sword-like weapon, called the 'parangilang', is used both as a weapon, and also for felling trees, and the axe of this country is constructed so that, by turning it on the helve, it can be used either as a weapon or as a carpenter's axe. In like manner, the Kaffir axe-blade, by simply altering its position in the handle, is used either as a weapon, or for tilling the ground. The North American Indian tomahawk, like the Kaffir axe, is used for many different purposes; the spear-head of the Kaffir assegai is the knife that is used for all purposes of manufacture, and Captain Grant says that the Watusi of East Central Africa make all their baskets with their spear-heads.[2] The weapons edged with sharks' teeth, to which I referred in my former paper, are used in the Marquesas and other of the South Sea Islands, as much for cutting up fish and carcasses as for warlike purposes.[3] Dr. Klemm, in his valuable work on savage and early weapons, describes the wooden pick used by the inhabitants of New Caledonia both as a weapon, and also for tilling the ground,[4] and he gives reasons for supposing[5] that in Egypt and many other parts of the world, the form of the plough was originally derived from that of the hatchet or hoe, used for tilling purposes. The hoe used in East Central Africa, which also, like the Kaffir axe, serves as a medium of exchange in lieu of money, evidently derived its form from that of a spear or arrow head. The spade, formerly used in this country, and represented in old pictures, which is still used as a shovel in Ireland, is a pointed spear-like instrument, and the 'loy' or spade still used in all parts of Ireland is hafted exactly in the same manner as the bronze celt of prehistoric times. Dr. Klemm (l. c., p. 119) gives an illustration of an axe used by the Norwegian peasants both as a tool and weapon. Speke describes the Usoga tribe[1] as being armed with huge short-handed spears, adapted rather for digging than for war; and Barth describes the Bornouese troops in Central Africa digging holes with their spears, and employing them in searching for water.[2] The Australian 'dowak', a kind of club with a flint attached, combines the purposes of a tool and weapon. We know from the short sticks upon which the small arrow-heads of quartz found in the Peruvian tombs are mounted, that they must have been used as knives as well as for missile purposes. Professor Nilsson says that flint-barbed arrow-heads, of precisely the same form, are used by the inhabitants of Tierra del Fuego as knives,[3] and Mr. Stephens, in his travels in Central America, shows reason for supposing that the large stone idols in Copan were carved with similar arrow-points,[4] no other instrument capable of being used for such a purpose having been found in the neighbourhood.

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[1] Klemm, l. c., p. 147.

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[1] Pinkerton (1811), vol. ix. p. 501.

[2] *Walk across Africa*, p. 78.

[3] Klemm, l. c., p. 62.

[4] l. c., p. 78.

[5] l. c., pp. 123–6.

Examples of this class of evidence might be multiplied *ad infinitum*; but enough has already been said to afford good grounds for believing that many of the implements of stone and bronze which are found in the soil, may have been used for a great variety of purposes, and that, especially in the earliest stages of culture, we must be careful how we attribute especial purposes to tools and weapons because they appear to differ from each other slightly in form. This is more especially so when, as is almost invariably the case, the several distinct types are found—when a sufficient number of them are collected and arranged—to pass almost imperceptibly into each other by connecting links; showing that the differences observable between any two implements of the same class, when brought together and contrasted, are rather due to the operation of a law of variation and development in the fabrication of the tool itself, than to an intention on the part of the constructor to adapt it to particular purposes, and that its application to such especial purposes must have followed, rather than itself have influenced, the development of the tool.

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[1] Speke, *Journal of the Discovery of the Source of the Nile* (London, 1863), p. 460.

[2] Barth, *Travels*, vol. iii. p. 162.

[3] Nilsson, *The Primitive Inhabitants of Scandinavia*, edited by Sir John Lubbock (3rd ed., London, 1868), p. 44.

[4] Lloyd Stephens, *Incidents of Travel in Central America* (London, 1854), p. 94.

Transition from the Drift to the Celt Type.

My first illustration must of necessity be taken from the flint implements of the drift, the earliest records of human workmanship that the researches of science have as yet revealed to us. These, to use the words of Sir Charles Lyell, 'were probably used as weapons both of war and the chase, to grub roots, cut down trees, or scoop out canoes.'[1]

I will not attempt during the brief time allotted to me on the present occasion, any detailed account of the evidence of the antiquity of these weapons, assuming that the works of Sir Charles Lyell, and Sir John Lubbock, will have rendered this subject more or less familiar to most persons at the present day, but I will confine myself to pointing out the indications of variation and of improvement observable in the implements themselves.

I have arranged upon diagram No. 1 (Plate XII) a series of specimens of the same type from nearly every part of the globe.

All the figures given in these diagrams are traced from the implements themselves, and reduced by photography; they may therefore be regarded as facsimiles, a point of great importance when our subject has to deal with the minute gradations of difference observable between them. Figures 1 to 11 are of the drift type. Casts of the originals of some of them, and specimens of the implements themselves, are also upon the table for comparison.

I may here acknowledge the great obligation I am under to Mr. Franks for the facilities he has afforded me in drawing many of these specimens in the Christy Collection; to Dr. Watson for a similar permission in regard to the valuable collection of arms in the India Museum; and also to Dr. Birch of the British Museum. A large proportion of my illustrations are taken from the excellent Museum of this Institution, and others are from my own collection.

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[1] Lyell, *Antiquity of Man* (London, 1873), p. 161.

Of the drift specimens which I have selected to illustrate the diagrams, five are from the gravel beds of St. Acheul, in order that we might have an opportunity of observing the variation in implements derived from the same locality, and probably belonging to the same or nearly the same period—chips in fact from the same workshop.

It has been usual to classify these drift implements in two divisions; the spear-head form, and the oval form. Of the first or spear-head form, figures 2 to 4 are typical examples; of the oval form, figure 8 is the best illustration. I venture, however, to think that a distinction more clearly embodying a principle of progress may be made by dividing them differently, and by placing in the first class those which are either left rough or rounded at one end and pointed at the other, of which figures 1 to 7 are examples; and in the second class, such as are chipped to an edge all round, of which figures 8 to 11 are types. My reason for preferring this classification to one dependent on outline is this. The first class having the natural outside coating of the flint or a roughly rounded surface on one side, appears to be in every way adapted to be held in the hand; whereas the second class, of which a beautiful specimen in the Christy Collection from St. Acheul is represented in a front and side view in figure 10, could not conveniently be used in the hand as a tool or weapon, without injury to the hand from the sharp edge with which its periphery is surrounded on all sides. If, therefore, we see reason for supposing that one class of implements was employed in handles, whilst the other may have been used in the hand, I think this constitutes a more important distinction, and one more obviously implying progress, than a classification which merely involves a modification of outline, which may have resulted from no more significant cause than a difference in the form of the flint nodule out of which the implement was made.[1]

Another important distinction between these drift implements as thus arranged, arises from the different purposes to which they may have been put by the fabricators. The first class, figures 1 to 7—it will be seen by the side view of them—could have been used only as spears, picks, or daggers, the pointed or small end being employed for that purpose, whereas the latter class, figures 8 to 11, are equally available for use as axes with the sharp and broad end. It is quite possible therefore, that we may see here, in these vestiges of the first tools of mankind (specimens of all varieties of which are found in the same beds at St. Acheul), the point of divergence between the two distinct classes, which must certainly be regarded as the two most constant and universal weapons of mankind in all ages and countries of the world, viz. the spear and the axe; the small end developed into the spear and into all that class of tools for which a point is required; and from the broad end we obtained the axe and all those tools which either as chisels, choppers, gouges, or battle-axes, have continued in use with an endless continuity of development and modification, and a world-wide history up to the present time. I am aware that in the St. Acheul implements, as well as in those of similar form from the laterite beds of Madras, we find occasionally specimens in which the small end is made broader, as if indicating the gradual development of an edge on that side, but upon the whole I think the balance of evidence is in favour of the broad end having originated the axe form.

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[1] I am informed by an eye-witness, that the Australian savages, in climbing trees, use implements nearly similar to these, to cut notches for their feet. The implement is held in the hand, without any handle. Others are used in handles, either fastened with gum, or consisting of a withe passed round the stone and tied underneath.

Nothing, it will be seen, can be more primitive than these tools, or more gradual than their development. They are perfectly consistent with the idea that the fabricators of them were in a condition closely verging upon that of the brutes. Apes are known to use stones in cracking the shells of nuts. The advantage to be derived from a pointed form, when it accidentally fell into the hand, would suggest itself almost instinctively to any being capable of profiting by experience and retaining it in the memory. Accidental fractures, producing a sharp edge, would lead to fractures of design, and thus we may easily suppose that such implements as are represented in the first few figures of our diagram must necessarily have resulted from the very earliest constructive efforts of primaeval man.

From the very first, a peculiar mode of fabrication appears to have been adopted, which consisted of chipping off flakes from alternate sides of the flint, and the facets thus left upon the flint produce the wavelike edge which you will see in the side views of all the implements here represented. This method continued to be employed throughout the entire stone age, in all parts of the universe, and is characteristic not merely of the drift, but of the cave, pfahlbauten, and surface periods.

The numerous intermediate gradations of form, whether between the oval and the spear-head form, or between the thick and the sharpened form, have been noticed by Sir Charles Lyell (l. c., p. 164). By selecting specimens, and arranging them in order from left to right, I have endeavoured to trace the transition from the drift type to the almond-shaped celt type, which latter is common to the stone age of mankind, whether ancient or modern, in all parts of the world.

Had the discovery of drift implements been confined to one locality or to one district, it is probable it would have attracted but little notice. As early as the first year of the present century the attention of the Society of Antiquaries had been drawn by Mr. Frere to the existence of these implements, in conjunction with the remains of the elephant and other extinct animals at Hoxne in Suffolk. An illustration of the specimens from this locality is given in figure 4. Mr. Frere described them as 'evidently weapons of war, fabricated and used by a people who had not the use of metals'. But little or no attention was paid to the subject until the discovery by M. Boucher de Perthes of precisely similar implements associated with the same class of remains, in the drift gravel of St. Acheul, near Amiens, in 1858.[1] Since then many other discoveries have been made, and still continue to be made, by Mr. Prestwich, Mr. Evans, Mr. Flower, Mr. Bruce Foote, and others, not only in this country but also in Asia and Africa, showing, in so far as the discoveries have hitherto gone, that this drift type, like the almond celt type, is common to the earliest ages in all parts of the world, and that everywhere the drift type preceded the almond-shaped celt type, and is found in beds of earlier formation.

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[1] Mr. Frere's first discovery was in 1797 (*Archaeologia*, xiii. p. 204). (M. Boucher de Perthes began work in 1837 (*De la Création*, Paris, 1838), and published his *Antiquités Celtiques et Antédiluviennes* (vol. i) in 1847. His discoveries were, however, not verified and accepted by the British observers till 1858–9.—Ed.)

Figure 5 is a drift-shaped implement from the laterite beds of Madras, of exactly the same form as those found in England. Figure 6 is an implement of the same class from the Cape of Good Hope, found fourteen feet from the surface. In America, implements of the drift type have not yet been discovered, but stone spear-heads have been found in Missouri in connexion with the elephant and other extinct animals. Figure 11 is from a mound of sun-dried bricks at Abou Sharein, in Southern Babylonia, obtained by Mr. J. E. Taylor, British Consul at Basrah; it is a chipped flint; in form it is of the drift type, and its outline is precisely that of some of the Carib celts found in the West India Islands; it also closely resembles in form others from the Pacific[1]; its edge was evidently at the broad end. Another of the same type was found at Mugeyer in Babylonia, and a third closely resembling the two former was found in a cave in Bethlehem.

The celt type has not as yet been found in the French caves of the reindeer period, but it is common in the 'pile dwellings' of the Swiss lakes. Some of the French cave specimens, however, closely approach the drift form, and in place of the celt, we have a peculiar kind of tool trimmed to a cutting edge on one side and having the other round for holding in the hand. As, however, these do not fall into the direct line of development, but may be regarded as a branch variety, I have not figured them in my diagram, but pass at once, though almost imperceptibly as regards form, from the drift to the surface type.

Figure 12 formed part of a large find of flint implements, discovered by myself in the ancient British camp of Cissbury, near Worthing—an account of this discovery was communicated by me to the Society of Antiquaries at the commencement of the present year.[2] The period of these Cissbury implements must be fixed at a very much more modern date than those of the drift, with which they are associated in my diagram, having been found in conjunction with the earliest traces of domestic animals, such as the Bos longifrons, Capra hircus, and Sus; they may, however, be classed with the stone age, no trace of metal having been discovered with them, although from 500 to 600 flint implements were found in the camp. The peculiarity of the Cissbury find, however, consists in the discovery (in the same pits in which celts of the type represented in figure 12 were found) of a few flints closely approaching the drift type, being thick at the broad end, and also of a large number resembling those found in the French caves, trimmed to an edge on one side, and adapted to be held in the hand. So that the Cissbury find, although belonging to what is usually called the surface period, contains specimens affording every link of connexion between the drift and the almond-shaped celt type. This discovery must, I think, be regarded as a step in knowledge of prehistoric antiquity, and a decided accession to the science of continuity, for Sir John Lubbock has told us in his preface to the work of Professor Nilsson, lately published[1], that the Palaeolithic, i. e. the drift types, 'have never yet been met with in association with the characteristics of a later epoch.' I shall therefore be interested to know whether, after an examination of the Cissbury specimens, which I have presented to the Christy Collection, Sir John Lubbock may be induced to alter his opinion on that point; for I think it is entirely consistent with all that is known of early races of mankind, that early types should be retained in use long after the introduction of others that have been developed from them. However this may be, I think that in casting the eye from left to right along the upper row of diagram No. 1 (Plate XII), it will puzzle the acutest observer to determine where the drift type ends, and that of the celt begins. If it is contended, as I am aware it will be contended by some, that the typical characteristic of the celt consists in its being sharp at the broad end, while those of the drift are blunt at the broad end, I reply that many of the drift specimens are also sharpened at the broad end, more especially those represented in figures 9 and 10 from the drift of St. Acheul. Many specimens from Thetford which I have seen, as, for example, Fig. 17 *b*, from a cast in the collection of the Society of Antiquaries, presented by Mr. Flower, approach equally closely to the celt type, as do some of those from the laterite beds of Madras, and though they are of rare occurrence in all these localities, and are certainly a variation from the normal type of drift implements, still they are found in sufficient numbers to serve as links in connecting the forms of the earliest, with those of the later period.

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[1] See figures 23 and 32, as well as figure 17 *a* from Central India.

[2] March 5, 1868. *Proc. Soc. Ant. Lond.* 2nd Ser. iv. p. 85: *Archaeologia*, xlii.

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[1] Nilsson, *The Primitive Inhabitants of Scandinavia*, edited by Sir John Lubbock (London, 1868), Editor's Introduction, p. xxiv.

I have dealt somewhat at length upon this part of my subject, owing to the circumstance of its presenting some features of novelty in the study of flint implements, and being therefore open to criticism on the part of those who are more favourable to the principles of classification than of continuity, with all the important concomitants, of division *versus* unity, which those principles involve.

I may now pass briefly over the remaining figures in the diagram. Figure 13 is a specimen found by Mr. Evans at Spienne, near Mons; its very close resemblance to figure 12 from Cissbury will be noticed; in fact the whole of the Spienne specimens resemble very closely those discovered in Cissbury, except that the Spienne implements of this class are associated with others of polished flint, which gives them a more advanced character than those derived from Cissbury, in which place only one fragment of a polished implement was discovered, and that in a part of the intrenchment which renders it very doubtful whether it ought to be associated with the Cissbury find. Figures 15, 16, and 17 are from Denmark, Ireland, and Yorkshire;—this type, however, is rare in Denmark, most of the flint implements from that country being of a more advanced character, and having usually a rectangular cross-section.

The lower row of the diagram consists of specimens derived, either from what has been termed the neolithic or polished stone age of Europe, or from savages who are still in a corresponding stage of progression in various parts of the world at the present time.

To the former or neolithic stone age of Europe belong figure 21 from France, figure 25 from the bed of the Clyde in Scotland, figure 27 from the Swiss lake-dwellings, figure 29 from the caves in Gibraltar, figure 30 from Sweden, figure 36 from Portugal, figure 37 from the bed of the Thames, figure 38 from Ireland, figure 39 from Jelabonga, in Russia. Precisely identical forms are also found in Germany, Italy, and the Channel Isles. Amongst the specimens derived from the ancient stone age of other parts of the world, and belonging to an age of civilization that is now extinct, may be enumerated figure 22 from Peru, figure 40 from Mexico, figure 24 from Central India, figure 41 from Japan, figure 42 from Mugeyer, in Babylonia. Nearly similar ones, but flattened at the side, like those common in Denmark, have been obtained from China and Pegu. Figure 43 is from Algeria, from the collection of Mr. Flower.

The following are examples of the same class of implements, used by savages of our own, or of comparatively modern times:—Figures 18 and 19 from Australia; these are generally used in a handle, formed by a withe twisted round them in the manner still used by blacksmiths in this country. Sometimes, however, I am informed by an eye-witness, the Australians use these celts in the hand without any handle at all. Although polished on the surface, these Australian celts have been compared by Sir Charles Lyell (l. c., p. 79) to the oval forms of the drift represented in figure 7. The art of polishing appears to have preceded the development of form in this country. Figure 20, from New Zealand, is a specimen in Mr. Evans's collection, of which he has been so kind as to allow me to take an outline; this form, however, is extremely rare in New Zealand, the usual shape of the stone celts from that country being flat-sided, like the specimens from Denmark, already noticed. Figure 23 is from the Pacific; figure 26, from Pennsylvania; these were used by the American Indians, previously, and for some time after the immigration of Europeans. Figures 31 and 32 are Carib celts from my collection, beautifully polished. Figure 33, from St. Domingo, is in the Cork Museum. Figure 34, from the Antilles, is in the Christy Collection; both of these have a human face engraved upon them. Figure 35 is of jade, from New Caledonia, in my own collection.

Hafting.

The method of hafting these implements, employed by savages, shows that they were used for a variety of purposes; in some, the edge is fastened at right angles to the handle, to be used as an adze, whilst in others the same tool is fastened with the blade in a line with the handle, to be used as a chopper or battle-axe. In some it is fastened with a withe, passed round the stone, as in the specimen from Australia (fig. 44, from this Institution) and some parts of North America; figure 45 is a stone axe from the

Ojibbeway Indians, from my collection. At other times it is inserted in the side of a stick or club. A specimen in my collection from Ireland (fig. 46), one of the few that have ever been found with handles, shows that this was the method employed in that country.[1] Others are inserted in the end of a bent stick (fig. 47), a mode of hafting common in the Polynesian Islands, in Africa, Ancient Egypt, Mexico, North America, and New Caledonia; it is employed by the Kalmucks and others, and was used during the bronze age. Some of the Australian axes were fastened to their handles by a peculiar preparation of gum manufactured for that purpose.

Dr. Klemm, in his 'Werkzeuge und Waffen', supposes the first lessons in hafting to have been derived from nature, by observing the manner in which stones are often firmly grasped by the roots of trees growing round them, and he gives several woodcuts of specimens of Nature's hafting, which he has collected from various sources; one of these, extracted from his work (l. c., p. 14), is represented in figure 48. I have placed upon the table, in illustration of this idea, an iron mediaeval axe-head (fig. 49), which has furnished itself with a handle in this manner, whilst buried beneath the surface; it is said to have been found in Glemham Park, Suffolk, eleven feet from the surface. Even to this day, when a peasant in Brittany discovers one of these stone celts upon the ground, he is in the habit of splitting the branch of a young tree and inserting the celt into the cleft; in the course of a year or two it becomes firmly fixed, and he then cuts off the branch, and uses the implement thus hafted by nature as a hammer for driving nails. In the 'Antiquités Celtiques et Antédiluviennes,' vol. i (Paris, 1847), p. 327, M. Boucher de Perthes mentions the discovery of two ancient stone hammer-heads, which appeared to have been furnished with handles by passing the hole over the bough of a tree and allowing it to fill up the aperture by its natural growth, until it became fixed as a handle.[2]

It might be interesting, if space permitted, to follow up the development of the stone axe-head through its various phases until, in the latest stages, when bronze had already come into general use for weapons, we find it furnished with a hole through the middle for the insertion of the handle. It may, I think, be safely said that—although nature furnishes numerous examples, in many classes of rocks, and especially in flints, of stones perforated with holes, and although they appear to have attracted the notice of the aborigines of many countries by the peculiar superstitious reverence which is often found to be attached to such stones when found in the soil—this mode of fastening stone implements in their handles did not come into use until late in the stone age, and that even in the bronze age it was but little employed.

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[1] The handle, since its discovery, has been fractured in four places, and has shrunk a good deal from its original size.

[2] Cf. Kemble, *Horae Ferales* (London, 1863), p. 134.

Transition from Oval to Rectangular Forms.

Whether the stone celts having a square or rectangular section (such as are found principally in Denmark, New Zealand, Mexico, and Pegu), were coeval, or of subsequent development, to those of the almond-shape type, may be a matter for conjecture; the small flint hatchets found in the Kitchenmiddens of Denmark appear to approach closely to the rectangular type. It is certain, that in the Swiss Lakes both forms are found fully developed, and it may be mentioned, as an instance of the constant tendency to variation that is everywhere observable in the weapons of the early races of mankind, that of the whole of the celts found at Nussdorf, in the Lake of Constance, though all might be traced to the same normal type as regards their general outline, no two were alike; and Dr. Keller gives sections, showing every conceivable gradation from the square and rectangular to the oval and circular section[1]. It may, however, be affirmed, that convex forms, as a general rule, preceded those having a rectangular or concave surface; it is so in the forms of nature; the habitations of animals are almost invariably convex. Dr. Livingstone mentions[2] that he found it impossible even to teach the natives of South Africa to build a square hut; when left to themselves for a few minutes, they invariably reverted to the circle. All the earliest habitations of prehistoric times are found to be circular or oval; even the sophisticated infant of modern civilization, when he plays with his bricks, will invariably build them in a circular form, until otherwise instructed.

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[1] Keller, *The Lake Dwellings of Switzerland*, transl. by J. E. Lee (2nd ed. London, 1878), vol. i. pp. 111–8.

[2] Livingstone, *Missionary Travels and Researches in S. Africa* (1857), p. 40.

Development of Spear and Arrow-head Forms.

We must now turn to the development of the second great class of weapons—the spear and arrow. These may be classed together, the arrow being merely the diminutive of the spear; and it may be taken as a general rule, applicable to all the arts of prehistoric times, that when a given form has once been introduced, it will speedily be repeated in every possible size that can be applied to any of the various purposes for which such a form is capable of being used. Size, in the arts of the earliest ages, is no indication of progress. In the same way it may be said of the development of the animal or vegetable kingdom, size is no indication of improved organism.

In the same beds in which the drift-type implements are found, flakes, either struck off in the formation of such tools, or especially flaked off from a core in a particular manner, indicating that they were themselves intended for use as tools, are found in considerable numbers. No more useful tool could have been used during the stone age than the plain, untouched flint flake, which, from the sharpness of the edge, is capable of being used for a variety of purposes. Those, for example, formed of obsidian are so sharp that it is recorded, by the Spanish historians, that the Mexicans were in the habit of shaving themselves with such flakes. As my present subject has to deal exclusively with war weapons, I will not enter into a detailed description of these flakes, further than to observe that they are found, together with the cores from which they were struck off, in every quarter of the globe in which flint, obsidian, or any other suitable material has been found, and that everywhere the process of flaking appears to have been the same.

Now, the fracture of flint is very uncertain; by constant habit, the ancient flint-workers appear to have been able to command the fracture of the flint in a manner that cannot be imitated, even by the most skilful forgers of those implements in modern times; but, notwithstanding this, the varieties of the forms of the flakes thus struck off must have been very considerable, and these varieties must, from the very first, have suggested some of the different forms of tools that were made out of them.

I cannot, perhaps, explain this point better than by exhibiting a number of flakes, found by myself in the bed of the Bann at

Toom, in Ireland, at the spot where that river flows out of Lough Neagh. This was a place originally discovered by Mr. Evans, where probably, in a habitation built upon the river, they formerly manufactured flint implements; and the bed of the river for the space of a hundred yards or more is covered with the flakes. It will be seen on examining these flakes, that some of them came off in a broad leaf-shaped form, and these, with a very little additional chipping, have been formed into spear-heads. Others longer and thicker have been chipped into something like picks, and others thinner and narrower than the two former, have been used probably as knives; others for scraping skins. We see from this that certain forms would naturally suggest themselves through the natural fracture of the flint, and this may to a certain extent account, though it does not, I think, entirely account, for the remarkable resemblance of form and unity of development observable in the spear and arrow heads, derived from localities so remote from each other as almost to preclude the possibility of their having ever been derived from a common source.

I have arranged in tabular form, on diagram No. 2 (= Plate XIII), representations of spear and arrow heads from all the different localities from which I have been able to obtain them in sufficient number to show fairly the numerous varieties which each country produces. On the top of the diagram, from left to right, the several forms are arranged in the order that appears most truly to indicate progression; but it must not be supposed that this arrangement is absolutely correct, for the several forms, such for example as the tang and the triangular form, were most probably derived from a common centre. The specimens from each locality ought therefore, in order to display their progression properly, to be arranged in the form of a tree, branching from a common stem. On the left of the diagram are written the different periods and localities, from which the specimens are derived. Commencing with the drift—the oldest of which we have any knowledge—which is coeval with the elephant and rhinoceros in Europe, we have the peculiar thick form already described. The examples of the drift period here shown, from their small size, must evidently have been used with a shaft, as they are scarcely large enough to have served as hand tools.

None of the lozenge, tang, or triangular forms, have ever been found in the drift.

The next line represents specimens from the French caves of the reindeer period, which are taken from the *Reliquiae Aquitanicae*, chiefly from Dordogne.[1] It will be seen that in these caves the first rude indications of the lozenge and tang form are represented, but no perfect specimens of either class. No example of the triangular form has been discovered. The leaf-shape form, however, is well represented.

In the ancient habitations of the Swiss Lakes, which belong to a later period, all varieties, except those of the drift type, are represented, but none of them in their most fully developed form; the tangs, it will be seen, are long, and the barbs comparatively short; the triangular form, which I consider to be the latest in the order of development, is mentioned by Dr. Keller, from whose work these specimens are taken, as being extremely rare. The comparative rarity of flint implements in the Lakes may, however, in some measure be accounted for, by the absence of flint in the district, necessitating the importation of this material from a distance.

The specimens from Yorkshire, Ireland, Sweden, Denmark, Italy, and Germany, may be considered to carry the development of these forms up to the latest period, viz. the late stone, and early bronze age; for there can be no doubt from the number of arrow-heads found in these countries, in connexion with implements of bronze, that they were used for missile purposes long after the *armes blanches* had been constructed of metal.

In all these localities it will be seen that the various gradations of form are identical; but as I have been able to collect a much larger number of arrow-heads from Ireland than elsewhere, the development of form is more apparent in the specimens selected from that country.

From the leaf-shape, it will be observed, there is every link of transition into the perfect lozenge type, and the latter is as a general rule, both in Ireland and in Yorkshire, much rarer, and more carefully constructed, than the leaf-shaped type, showing that there is every probability of the lozenge having been an improved form.

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[1] Lartet and Christy, *Reliquiae Aquitanicae* (London, 1865-75, passim).

The tang form is represented, at first, by a few rude chips on each side of the base of the original flake, narrowing that part in such a manner as to admit of its being inserted into a handle or shaft, and bound round with a sinew. This is superseded by the gradual formation of barbs on each side, and these barbs are lengthened by degrees, until they reach to the line of the base of the tang; the tang subsequently shortens, leaving the barbs with a semicircular aperture between them, and thus approaching some of the forms represented in the triangular column. These latter barbed specimens are usually more finished, and chipped with greater care than the long-tanged ones, which are rougher, more time-worn, and probably of earlier date.

The triangular form is seen at first, with a straight base; gradually a semicircular aperture appears, and this deepens by degrees until, in some of the more carefully formed specimens, it approaches the form of a Norman arch. This last variety is especially well represented in Denmark.

Sir William Wilde's arrangement, in his *Catalogue of the Royal Irish Academy*,[1] differs in some respects from this; he considers the triangular an early form, and he assigns the final perfection of the art of fabricating flint spear-heads, to the large lozenge-shape form; grounding his opinion on the circumstance of many of this form, of the larger size, having been found polished, whilst those of the leaf, triangular, and tang shape are not usually carried further than the preliminary process of chipping. But it is evident that these larger forms may have been used for spears, the lozenge shape being especially adapted for this purpose, as enabling the owner of it to withdraw it from the wound, after slaying his adversary; while those of the barbed and triangular form being lighter, and calculated to stick in the wound, would be better adapted for arrow-heads: and it is unlikely that the same amount of labour would be expended on a weapon intended to be cast from a bow, as upon one designed to be held in the hand. I consider the polishing of these particular weapons therefore to be no criterion of age, but merely to indicate that they were used as *armes d'hast*, and not as missiles.

It appears highly probable, however, that all the several varieties, if not developed simultaneously, were used at the same time; for we find amongst the Persians, the Esquimaux, and many other nations, that a great variety of arrow-heads are carried in the same quiver, and are used either indiscriminately or for different purposes[1].

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[1] Wilde, *Catalogue of the Antiquities of the Museum of the Royal Irish Academy* (Dublin, 1863), vol. i. pp. 19–23.

In the eighth row from the top, I have arranged a series of similar forms from America, obtained chiefly from Pennsylvania, but they are also found in other parts of the continent, and some few of the illustrations here given (Plate XIII, figs. 131, 132, and 133) are from Tierra del Fuego. Their forms enable them to be arranged under precisely the same divisions as those from the continent of Europe, and in each division the same development is observable. The tang or barbed form, however, differs sufficiently from the European forms of the same class to show that they arose independently, and were not derived from a common source. The tang of the American arrow-heads, it will be seen, is broader, at least in the later forms, and it appears to have originated in a notch on the sides of the blade, intended to hold the sinew with which it is attached to the shaft or handle. This notch appears to have been constructed lower and lower on the sides of the blade, until at last it comes down quite into the base of the flint, and it then closely resembles the European in form; compare, for example, figures 94 and 136; except that the tang is broader, and has a lateral projection on each side, so as to render it firmer in the shaft when bound by the sinew.

Notches at the side of the blade are extremely rare in Ireland, but from Sweden Professor Nilsson gives a drawing of an arrow-head, which I have copied into my diagram (figure 96). It is precisely identical, in its peculiar form, to one here figured from America (figure 139), and they both have a concave base, in addition to the side notch; thus apparently representing a transition form between the tang and the triangular, which I have never noticed, except in the two specimens here referred to, and which must be regarded in Europe as extremely rare.

To illustrate the mode of fixing these instruments in their shafts,

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[1] After having witnessed the process of fabricating flint arrow-heads, as re-discovered by Mr. Evans, I am able to understand why it is that the leaf-shaped form is of more frequent occurrence, and why this and the long-tanged forms are so often rougher and less finished than the other forms, the deep barbs and hollow base requiring much greater skill than the former.

I have here figured several examples from my collection; two of these (figures 163 and 164) were derived from the Esquimaux, between Icy Cape and Point Barrow, the person from whom I purchased them having brought them himself from that locality. Figures 165, 166, and 167, are from California.

Burton says that the Indians between the Mississippi and the Pacific use the barbed form only for war[1]; and Schoolcraft, in the *Archives of the Aborigines of America*,[2] gives illustrations of two methods of fastening, one for war and the other for the chase, the former being loosely tied on, so as to come off when inserted in the wound.

But, in addition to their use as arrow-points, we have reason to suppose that they were used also as knives. I have represented in the diagram (figures 168 and 169) two short-handled instruments from Peru, which are now in the British Museum, into which similar arrow-points are inserted. These, from the shortness and peculiar shape of their shafts, could hardly have been used as darts. The only weapon peculiar to those regions from which such an instrument could have been projected, is the blow-pipe, and they are entirely different from the darts used with the blow-pipe either in South America, the Malay Peninsula, or Ceylon, in which countries the blow-pipe is used. There is reason to believe, from the manner in which they are placed in the graves, unaccompanied by any bow or other weapon from which they could have been projected[3], that they were employed as knives, and this is confirmed by the fact, already mentioned, of the inhabitants of Tierra del Fuego using their arrow-points for knives. The great numbers in which they are found in Ireland, in Yorkshire, and other localities appertaining to the late stone age, in which places they form the greater part of the relics collected, and are always the most highly finished implements discovered—the other stone implements associated with them being either celts, flint-discs, picks, or rough or partially worked flakes, that are capable of being wrought into arrows—the fact that the peculiar modification of form observable at the base of these implements appears to have been designed rather to facilitate the attachment of them to their wooden shafts or handles, than for the special purposes of war; and the frequent marks of use, as if by rubbing, that are found on the points of many of them, especially in the specimens from Ireland; all these circumstances favour the supposition that in Europe, as well as in America, these arrow-head forms were used for many other purposes besides war and the chase; and that, like the assegai of the Kaffir, and the many other examples of tool-weapons already enumerated, we may regard them as having served to our primaeval ancestors the general purposes of a small tool available for carving, cutting, and for all those works for which a fine edge and point was required. On the other hand the celt undoubtedly provided them with a large tool capable of being applied to all the rougher purposes, whether peaceful or warlike, for which it was adapted in the simple arts of an uncivilized people.

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[1] Burton, *The City of the Saints* (London, 1861), p. 146.

[2] Schoolcraft, *Information concerning . . . the Indian Tribes of the U.S.A.* (Philadelphia, 1851–9), vol. i. p. 212.

[3] In the museum belonging to the Cork College, there is a Peruvian mummy, with which, amongst other articles, two of these arrow-pointed knives were found.

In the ninth row I have arranged, under their respective classes, the whole of the specimens of flint arrow-heads that are given in Siebold's atlas of Japanese weapons.[1] It will be seen that they present the same variety of form as those already described. A similar collection of flint arrow-heads has lately been added to the British Museum by Mr. Franks, and described by him. They formed part of a Japanese collection of curiosities, and are labelled in the Japanese character, showing that this remote country not only passed through the same stone period as ourselves, but that, as their culture improved and expanded, they, like ourselves, have at last begun to make collections of objects to illustrate the arts of remote antiquity.

Implements composed of Perishable Materials.

It is now time that I should say a few words respecting weapons constructed of more perishable materials; for it is not to be assumed that, because we find nothing in the drift-gravels but weapons of flint and stone, the aborigines of that age did not also employ wood and other materials capable of being more easily worked. If man was at that time, as he is now, a beast of prey, he must also have become familiar, in the very first stages of his existence, with the uses of bone as a material for fabricating into weapons. In the French caves, a large number of bone implements have been found, and their resemblance, amounting almost to identity, with those found in Sweden, amongst the Esquimaux, and the inhabitants of Tierra del Fuego, has been noticed by Sir John Lubbock, Professor Nilsson, and others.

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[1] Siebold, *Nippon* (Leiden, 1832–52), vol. i. pt. ii (Alte Waffen), Tab. xi.

But, in dealing with the subject of continuity and development, it is necessary to confine our remarks to those countries from which we have had an opportunity of collecting large varieties of the same class of implement; we must therefore have recourse to the Australian, the New Zealander, and those nations with which we are more frequently brought in contact.

Transition from Celt to Paddle, Spear, and Sword Forms.

The almond-shape celt form, as I have already demonstrated, is one so universally distributed and of such very early origin, that we may naturally expect to find many of the more complicated forms of savage implements derived from it. [See diagram No. 3, reproduced in Plate XIV.] In a paper in the *Ulster Journal of Archaeology* (Belfast, 1857, vol. v, pp. 125–27) a writer draws attention to the occurrence in the bed of the Bann, and elsewhere in the north of Ireland, of stone clubs, formed much upon the general outline of the celt, but narrowed at the small end, so as to facilitate their being held in the hand like a bludgeon. Fig. 50 is copied from the illustration given in the paper referred to, and fig. 51 is another in my collection, also from Ireland, of precisely the same form; the original is upon the table, and it will be seen that it is simply a celt cut at the small end, so as to adapt it to being held in the hand. Fig. 52 is an implement in common use among the New Zealanders, called the 'pattoo-pattoo', of precisely the same shape; it is of jade, and its form, as may be seen by the thin sharp edge at the top, is evidently derived from that of the stone celt. Fig. 53 is a remarkably fine specimen, from the Museum of this Institution; the handle part in this specimen is more elaborately finished. These weapons are used as clubs to break heads, and also as missiles, and the fact of their having been derived from the celt is shown by the manner in which they are used by the New Zealanders. I am informed by Mr. Dilke, who derived his information from the natives whilst travelling in New Zealand, that the manner of striking with these weapons is not usually with the side, but with the sharp end of the pattoo-pattoo, precisely in the same manner that a celt would be used if held in the hand. The spot selected for the blow is usually above the ear, where the skull is weakest. If any further evidence were wanting to prove the derivation of this weapon from the stone celt, it is afforded by fig. 54, which is a jade implement lately added to the British Museum from the Woodhouse Collection. It was, for some time, believed to have been found in a Greek tomb, but this is now believed by Mr. Franks to be a mistake; it is, without doubt, a New Zealand instrument. The straight edge shows unmistakably that the end was the part employed in using it, while the rounded small end, with a hole at the extremity, shows that, like the pattoo-pattoo, it was held in the hand. It is, in fact, precisely identical with the hand celts from Ireland, above described, and forms a valuable connecting link between the celt and pattoo-pattoo form. Now it may be regarded as a law of development, applicable alike to all implements of savage and early races, that when any form has been produced symmetrically, like this pattoo-pattoo, the same form will be found either curved to one side, or divided in half; the variation, no doubt, depending on the purposes for which it is used. The pattoo-pattoo, having been used at first, like its prototype the celt, for striking with the end, would naturally come to be employed for striking upon the side edge.[1] The other side would therefore be liable to variation, according to the fancy of the workman. Figs. 55, 56, and 57, are examples of these implements, in which the edge is retained only on one side and at the end, the other side being variously cut and ornamented. This weapon extended to the west coast of America, and there, as in New Zealand, they are found both of the symmetrical and of the one-sided form. Fig. 58 is one believed to be from Nootka Sound, in my collection. Fig. 59 is also from Nootka, in the Museum of this

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[1] Evidence of this transition may be seen by examining any number of pattoo-pattoos. Some are sharp at the end; others are blunt at the end, but sharp at the side near the broadest part.

Institution. Fig. 60 is an outline of one from Peru, which is figured in Dr. Klemm's work (l. c., fig. 46, p. 26), and I am informed that a nearly similar club has been derived from Brazil.

The same form as the pattoo-pattoo, in Australia, has been developed in wood. Fig. 61 is from Nicol Bay, North-West Australia, and is in the Christy Collection described as a sword. Fig. 62 is of the same form, also of wood, but of cognate form, from New Guinea. In fig. 63, which is also from New Guinea, we see the same form developed into a paddle. In the larger implements of this class we see the same form, modified in such a manner as to diminish the weight; thus, the convex sides become either straight or concave. I have arranged upon the walls a variety of clubs and paddles, from the Polynesian Islands, figs. 64 to 67, all of which must have been derived from a common source. The New Zealand steering-paddle, fig. 64, it will be seen, is simply an elongated celt form. Those from the Marquesas (fig. 65), Society Isles, Fiji, and Solomon Isles, &c., are all allied. In the infancy of the art of navigation, we may suppose that the implements of war, when constructed of wood, may have frequently been used as paddles, or those employed for paddles have been used in the fight, and this may perhaps account for the circumstance that, throughout these regions, the club, sword, and paddle pass into each other by imperceptible gradations. In the Friendly Isles we may notice a still further development of this form into the long wooden spear, specimens of which, from this Institution, are exhibited (figs. 68, 69, and 70).

We must not expect to find all the connecting links in one country or island. We know that the same race has at different times spread over a very wide area; that the Polynesians, New Zealanders, and Malays are all of the same stock, speaking the same or cognate languages. The same race spread to the shores of America on the one side, and to Madagascar on the other, carrying with them their arts and implements, and we may, therefore, naturally expect that the links which are missing in one locality may be supplied in another.

Development of the Australian Boomerang.

We now turn to the Australians, a race which, being in the lowest stage of cultivation of any with whom we are acquainted, must be regarded as the best representatives of aboriginal man.

I have transferred the Australian sword, Plate XIV (diagram 3), fig. 61, to Plate XV (diagram 4), fig. 72, in order that from it we may be able to trace the development of a weapon supposed by some to be peculiar to this country, but one which in reality has had a very wide range in the earliest stages of culture; I allude to the boomerang.[1]

The Australians, in the manufacture of all their weapons, follow the natural grain of the wood, and this leads them into the adoption of every conceivable curve. The straight sword would by this means at once assume the form of the boomerang, which, it will be seen by the diagram, is constructed of every shade of curve from the straight line to the right angle, the curve invariably following the natural grain of the wood, that is to say, the bend of the piece of a stem or branch out of which the implement was fabricated.

All savage nations are in the habit of throwing their weapons at the enemy. The desire to strike an enemy at a distance, without exposing one's self within the range of his weapons, is one deeply seated in human nature, and requires neither explanation nor comment. Even apes, as I have already noticed, are in the habit of throwing stones. The North American Indian throws his tomahawk; the Indians of the Grand Chako, in South America, throw the 'macana', a kind of club. We learn from the travels of Mr. Blount,[1] in the Levant in 1634, that at that time the Turks used the mace to throw, as well as for striking. The Kaffirs throw the knob-kerry, as did also the Fidasians of Western Africa.[2] The Fiji Islanders are in the habit of throwing a precisely similar club. The Franks are supposed to have thrown the 'francisca'.[3] The New Zealander throws his 'pattoo-pattoo', and the Australian throws the 'dowak' and the waddy, as well as his boomerang. All these weapons spin of their own accord when thrown from the hand. In practising with the boomerang, it will be found that it does not require that any special movement of rotation should be imparted to it, but if thrown with the point first it must inevitably rotate in its flight. The effect of this rotation, it will hardly be necessary to remind those acquainted with the laws of projectiles, is to preserve the axis and plane of rotation parallel to itself, upon the principle of the gyroscope. By this means the thin edge of the weapon would be constantly opposed to the atmosphere in front, whilst the flat sides, if thrown horizontally, would meet the air opposed to it by the action of gravitation; the effect, of course, would be to increase the range of the projectile, by facilitating its forward movement, and impeding its fall to the earth. This much, all curved weapons of the boomerang form possess as a common property.

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[1] Since this paper was read to the Royal United Service Institution, Sir John Lubbock has delivered a remarkably interesting series of lectures on savages, in the course of which he took exception to my classification of the Indian, African, and Australian boomerangs, under the same head; giving as his reason that the Australian boomerang has a return flight, whilst those of other nations have not that peculiarity. If it could be shown that the Australian weapon had been *contrived* for the purpose of obtaining a return flight, I should then agree with him in regarding the difference as generic. But the course of my investigations tends to show that this was probably an application of the weapon accidentally hit upon by the Australians, and that it arose from a modification of weight and form, so trivial as to prevent our regarding it as generically distinct from the others. I therefore consider the Australian weapon to be a mere variety of the implement which is common to the three continents. The difference between us on this point, though one of terms, is nevertheless important as a question of continuity. I am much gratified, however, to find my opinions on many other points supported by Sir John's high authority.

If any large collection of boomerangs from Australia be examined, it will be seen that they vary not only in their curvature, but also in their section; some are much thicker than others, some are of the same breadth throughout, whilst others bulge in the centre; some are heavier than others, some have an additional curve so as to approach the form of an S, some have a slight twist laterally, some have an equal section on both sides, while others are nearly flat on one side and convex on the other.

As all these varieties continued to be employed, it would soon be perceived that peculiar advantages were derived from the use of the flatter class of weapon, especially such as are flat on the under side, for by throwing these in such a manner as to catch the air on the flat side, instead of falling to the ground they would rise in the air, precisely in the same manner that a kite, (fig. 71), when the boy runs forward with the string, rises and continues to rise as long as it is kept up by the action of the air beneath. In like manner the boomerang, as long as the forward movement imparted to it by the thrower continues, will continue to rise, and the plane of rotation, instead of continuing perfectly parallel to its original position, will be slightly raised by the action of the atmosphere on the forward side. When the movement of transition ceases, the boomerang will begin to fall, and its course in falling will be by the line of least resistance, which is in the direction of the edge that lies obliquely towards the thrower; it will therefore fall back in the same manner that a kite, when the string is suddenly broken, is seen to fall back for a short distance; but as the kite has received no movement of rotation to cause it to continue in the same plane of descent, it soon loses its parallelism, and falls in a series of fantastic curves towards the ground. The boomerang will do the same thing if it loses its movement of rotation; but as long as this continues, which it usually does after the forward movement has ceased, it continues to fall back upon the same inclined plane by which it ascended, and finally reaches the ground at the feet of the thrower. There are various ways of throwing the boomerang, but the principles here enunciated will explain the course of its flight in whatever manner it may be thrown.

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[1] Henry Blount, *Voyage into the Levant*, 1634 (London, 1671), p. 91.

[2] Bosman, *Guinea*, Pinkerton (1811), vol. xvi. pp. 505–6.

[3] Kemble, *Horae Ferales* (1863), p. 65.

Now it is evident that this peculiar mode of flight would be of great advantage to the savage, for as we learn from a paper in *Trans. Ethnological Society* (N.S. iii. pp. 264–5), by Mr. Oldfield, who speaks from experience, the natives usually employ this weapon against large flocks of ducks or wild-fowl in rivers or marshes; the weapon after striking or missing the prey would return to the thrower, instead of being lost in the morass; its use, therefore, would give to the individual or tribe possessing it a great advantage over their neighbours in the struggle for life.

But it is evident that the principles of the flight of the boomerang, such as I have described it, according to the recognized law of projectiles, must have been entirely unknown to the savage; he can no more be said to have *invented* the boomerang than he can be said to have *invented* the art of sustaining life by nourishment. Instinct prompts him to eat; little better than instinct would enable him to select from amongst his weapons such as are found most suitable for obtaining food; and we have already seen how he may have been led to the adoption of such an instrument as the boomerang, purely through the laws of accidental variation, guided by the natural grain of the material in which he worked.

The boomerang, though used chiefly for game, is used also as a weapon, and Mr. Oldfield says that it is capable of inflicting a wound several inches in depth.

A further movement is effected in the flight of the boomerang by giving the arms a slight lateral twist, by means of which it is caused to rise by virtue of its rotation, screwing itself up in the air precisely in the same manner that a boy's flying top rises to the ceiling. By means of this addition, the weapon is sometimes made to strike an object in its fall to the ground, behind the thrower, but the twist is not by any means invariable, as any one may see by examining a collection of these weapons. Nor is it essential to ensure a return fall, which I have frequently ascertained by practising with a boomerang that was perfectly flat.

In examining Plate XV (diagram 4), it will be seen that the boomerang passes by imperceptible gradations from the straight sword, fig. 72, on the one hand, into the 'malga', a kind of pick, fig. 89, used for war purposes, on the other[1], and this Australian malga closely resembles a weapon of the same kind from New Caledonia, figs. 90 and 91, which, as already mentioned, is used both as a weapon and for tilling the ground. In Plate XV (diagram 5), figs. 92 to 100, I have also arranged the links of connexion between the boomerang and a kind of hatchet or chopper called the waddy. A slight swell or projection is seen to grow out of one end of the concave side of the boomerang, and this develops into the form of a chopper. In those specimens of this class in which the projection is only slightly developed, as in figs. 94 and 95, the sides of the implement are flat, and the weapon is obviously designed for throwing, but in some of those in which the projection is more fully developed, as in fig. 96, the shaft is quite round, and the head becomes thick and heavy, so as to render it totally unsuited to the purposes of a missile. We see, therefore, in this diagram, the transition, by minute gradations, from a missile to a hand weapon, or vice versa. The boomerang, the sword, the malga, and the waddy, are thus seen to be allied in such a manner as to make it difficult to determine which of the four was the original weapon, and, if properly arranged to display their development, they should be distributed in branch lines, starting from a common centre, exactly in the same manner that I have suggested the various forms of spear and arrow-heads ought to be arranged in the natural order of progression. [See, for example, Plate III, and pp. 37–8, above.]

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[1] This weapon is called 'leowel' by the Australians now in this country (1868).

Indian Boomerangs.

In Plate XV (diagram 6), figs. 101–5, I have arranged a series of boomerangs from India. Figures 101 and 102 are specimens of the 'katureea' or boomerang of Goojerat, from the Indian Museum; they are used by the coolies, according to the ticket in the Museum, 'for whirling at hares, boars, and other wild animals, and disabling them.' It is of 'raen' wood, thicker and heavier than the Australian specimens, and therefore not adapted to rise in the air and return. The section is equal on both sides, but in other respects it is precisely identical with the Australian weapon, and appears to have been roughly chipped into form. Figures 103 and 104 are of an improved form, from Madras, called the 'collery', also of wood, but having a knob at the handle end; they are from the Museum of this Institution. Figure 105 is precisely the same form in steel, from the India Museum. It is probable that this weapon led to the use of the steel 'chakra' or war quoit (fig. 106) of which I have given an illustration from the Museum of this Institution. The principle of its flight is precisely that of the boomerang, in so far as regards the increase of range and velocity produced by the rotation preserving the thin edge in the line of its forward motion. The earliest mention of this instrument is in the description of the Malabar Coast, by Magellan, about 1512, translated by Mr. Stanley, for the Hakluyt Society. The author describes amongst the arms used in the kingdom of Dely, certain wheels called chacarani, 'two fingers broad, sharp outside like knives, and without edge inside, and the surface of these is of the size of a small plate, and they carry seven or eight of these each, put on the left arm, and they take one and put it on the finger of the right hand, and make it spin round many times, so that they hurl it at their enemies, and if they hit any one on the arm or neck, it cuts through all, and with these they carry on much fighting, and are very dexterous.'[1] These weapons are usually worn on the head, but the circumstance here mentioned of their being worn on the arm, reminds us very much of the peculiar weapon worn by the Djibba negroes of Central Africa as a bracelet; this is represented in figure 107; it is of iron, sharp on the outside and blunt on the inside, which touches the arm; the edge is usually covered with a strip of hide to prevent injury to the person. I am not aware that this weapon of the negroes is ever used as a missile, but the occurrence of two such singular weapons, similarly carried, is worthy of notice, more particularly as we have clear evidence of a connexion between the metal-workers of the whole continent of Africa and the hill tribes of Central India.

It is possible that many links of connexion may be supplied when the subject of continuity comes to be more carefully studied in these countries. It would appear extremely probable that the small Koorkeree and Goorkah knife, though now used only for hand fight, may have had their origin in these missile weapons, which they resemble in form, especially the large Goorkah knife. It would be interesting to know if they are ever thrown. I have heard stories of this having been the case, but no authentic account of such a practice. The Spaniards throw their long clasp-knives with effect for a considerable distance.

African Boomerangs.

Turning to Africa (Plate XV, diagram 7), we find the boomerang well represented in many parts of that continent. Figure 108 is an ancient Egyptian boomerang of wood, in the British Museum. It was obtained from the collection of James Burton, Jr., Esq., which was formed by him in Egypt, and is described as 'an instrument for fowling, for throwing at, or knocking down birds, as is continually represented on the walls of the tombs'. It is of hard but light wood, the section is symmetrical on both sides, and not flat on one side, like some of the Australian boomerangs; it is somewhat broader at the ends than in the middle of the blade. Figures 100, 110, and 111, are taken from Rosellini's *Egyptian Monuments*,[1] and show how this instrument was used by the ancient Egyptians. Sir Samuel Baker has described the weapon called the 'trombash', used in those parts of Abyssinia which he traversed.[2] It is of hard wood, resembling the Australian boomerang, about two feet in length, and the end turns sharply at an angle of 30°; they throw this with great dexterity, and inflict severe wounds with the hard and sharp edge, but, unlike the boomerang, it does not return to the thrower. Figure 113 is a wooden instrument, in the Christy Collection, said to be used by the Djibba negroes for throwing at birds. Figure 114 is the Nubian sword, which in form exactly resembles the boomerang. They have a great variety of curves, some of them, especially those of the same form used in Abyssinia, bending nearly in a right angle. I am not aware that this instrument is ever thrown by the Nubians; they, however, are in the habit of throwing their curved clubs with great dexterity. Figure 115 is an iron implement of native workmanship, used as a missile by the inhabitants of Central Africa; it was brought from that region by Consul Petherick, at whose sale I purchased it. Like the majority of the succeeding figures represented in this diagram, it resembles the Australian boomerang, in being flat on the under side, that is to say, upon the side which would be undermost, if thrown from the right hand with the point first; the weight, however, would prevent such a weapon from rising in the air, or returning to the thrower. Figure 116 is used by the Mundo tribe of Africa; like the last, it is flat on the under side; in form it resembles the falchion, represented in the Egyptian sculptures as being held in the hand by Rameses and other figures, when slaying their enemies. The small knob on one side of the blade is used to attach it to the person in carrying it. Figure 117, from Central Africa, is clearly a development of the preceding figure. Figure 118 is a weapon of the same class, from Kordofan, obtained near the cataracts of Assouan, Upper Nile, and now in the Museum of this Institution; though of the same character as the other missiles, its section is equal on both sides, and therefore it is not calculated to range far in its flight. Figure 119 is also from the Museum of this Institution; it is flat on the under side. Figures 120 and 121 are from illustrations in Denham and Clapperton's *Travels in Northern and Central Africa* (Pl. xli. 3, 4), of the missile instruments, called 'hunga-mungas', used by the negro tribes, south of Lake Tchad. One of these is of very peculiar form; in the course of the innumerable variations which this weapon appears to have undergone, the constructor appears to have hit upon the idea of representing the head and neck of a stork. Figure 122 is from a sketch, in Barth's *Travels*, of one of these weapons, belonging to the Marghi, a negro tribe in the same region; it is called 'danisco', and he says that the specimen here represented is of particularly regular shape, thereby inferring that numerous varieties of form are in use among these people. In another place, he describes the 'goliyo' of the Musgu and the 'njiga' of the Bagirmi, as weapons of the same class, the name of the latter differing from the word for spear only in a single letter; he says this weapon is common to all the pagan, i.e. negro tribes, that he came across.[1] Figure 123 is from East Central Africa, presented to the Christy Collection by the Viceroy of Egypt; it is described as a cutting instrument, from the country of the Dinkas and Shillooks, capable of being thrown to a great distance. Mr. Petherick met with these tribes in his travels on the White Nile.[2] Figure 124, from my collection, is described as a battle-axe of the Dor tribe, between the equator and the 6th or 7th degree of north latitude. It was brought to England by Mr. Petherick, who obtained it in his travels in 1858; it is used also for throwing. Figure 125 is from an illustration in Du Chaillu's work,[3] of the missile tomahawk, used by the Fans in the Gaboon, in West Central Africa; he says that the thrower aims at the head, and, after killing his victim, uses the round edge of the axe to cut off the head. We see from this, that notwithstanding the innumerable and apparently meaningless variations which this weapon has undergone, the different parts of it are sometimes applied to especial uses. Figure 126 is another missile, used by the Neam-Nam tribes, East Central Africa. Mr. Petherick says, that the Baer tribe carry a different kind of iron missile from the Neam-Nams. Figures 126 to 129 are different varieties of Neam-Nam weapons, in which, as they are all derived from the same people, the gradual transition of form is more perceptible than in those isolated specimens derived from different tribes. If, however, we had specimens of all the varieties used by each tribe, we should without doubt be able to trace the progression of the whole of them from a common form. As it is, the connexion is sufficiently obvious when the details are examined, throughout the whole region in which they are found, extending from Egypt and the Nile in the East, to the Gaboon on the West Coast. In all, the principle of construction is the same, the divergent lateral blades serving the purpose of wings, like the arms of the Australian boomerang, to sustain the weapon in the air when spun horizontally. The variations are such as might have resulted from successive copies, little or no improvement being perceivable in the principle of construction throughout this region, notwithstanding the innumerable forms through which it must have passed during its transmission from its original source; the locality of which we shall probably be unable to determine, until the antiquities of the country have been more carefully described and studied. As, however, it is everywhere found in the hands of the negro aborigines of the country, it must probably have had the same origin as the art of smelting and fabricating iron, which is everywhere identical throughout this region, and is, without doubt, of the remotest antiquity, dating long prior to any historical record of the continent of Africa.

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[1] Duarte Barbosa, *A Description of the Coasts of East Africa and Malabar* (by Magellan), translated by the Hon. H. E. Stanley: Hakluyt Society, xxxv (1866), pp. 100-1.

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[1] Rosellini, *Monumenti dell' Egitto e della Nubia* (Pisa, 1834), Monuments Civiles, pl. cxvii. 3; cxix. 1.

[2] Baker, *Nile Tributaries of Abyssinia* (London, 1867), p. 511.

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[1] Barth, l. c., vol. iii. pp. 231, 451, &c., &c.

[2] Petherick, *Egypt, the Soudan, and Central Africa* (1861), p. 456.

[3] Du Chaillu, *Explorations and Adventures in Equatorial Africa* (London, 1861), p. 79.

Cateia.

The possible employment of the boomerang in Europe has been made the subject of occasional speculation amongst antiquarian writers. Having been used in Egypt, and perhaps in Assyria, there is no good reason for doubting that it may have spread from thence to the north-west. In a learned paper on the subject in the *Transactions of the Royal Irish Academy*, vol. xix (1843), § 'Literature,' p. 22, Pl. i, ii, Mr. Samuel Ferguson endeavours to prove that the 'cateia' mentioned by classical authors was the boomerang. He quotes several passages, and amongst them one from Virgil (*Aeneid* vii. 741), in which mention is made of a people accustomed to whirl the 'cateia' after the Teutonic manner. In the *Punica* of Silius (iii. 327), one of the Libyan tribes which accompanied Hannibal to Italy is described as being armed with a bent or crooked 'cateia'. Isidore, Bishop of Seville, a writer of the end of the sixth and beginning of the seventh century, described the 'cateia' as 'a species of bat, which, when thrown, flies not far, by reason of its weight, but where it strikes, it breaks through with extreme impetus, and if it be thrown with a skilful hand, it returns back again to him who dismissed it' (*Origines*, xviii. 7. 7).

Strabo also (pp. 196–7) describes the Belgae of his time, as using 'a wooden weapon of the shape of a grosphus, which they throw out of hand . . . which flies farther than an arrow, and is chiefly used in the pursuit of game'.

General Conclusions relative to the Boomerang.

Those who desire further information relative to its supposed use in Europe, cannot do better than refer to the paper from which I have quoted. Meanwhile, enough has been said to show :—(1) that the boomerang was used in many different countries at a very early period, and in a very primitive condition of culture, and that it was everywhere employed chiefly in the pursuit of game; (2) that it was everywhere constructed of wood, before it was copied in metal; (3) that in Australia it originated as a variety of the almond- or leaf-shaped sword, and was suggested by the natural curvature of the material out of which it was formed; (4) that the subsequent improvements by which its return flight was ensured, arose from a practical selection of suitable varieties, and was not the result of design, and (5) that the form of the boomerang passes by minute gradations into at least three other classes of weapons in common use by the same people, and may therefore be regarded as a branch variety of an original normal type of implement, used by the most primitive races as a general tool or weapon.

Development of the Club.

Amongst other implements used for war, the form of which appears to be derived from the same common source as those already described, may be included the Australian club, and the wamera or throwing stick. I have arranged in Plate XVI, diagram 8, figs. 130 to 137, a series of Australian clubs, showing a transition from the plain stick, of equal size throughout, to one having a nearly round knob at one end. Nearly similar forms to some of these, from Africa, figs. 138 to 140, are also represented on the same diagram.

Contrivances for Throwing the Spear.

Amongst the Australian 'wameras', there are so many varieties, that it is next to impossible to speculate upon the priority of any particular form, unless the plain stick, with a projecting peg at one end, may be regarded as certainly the simplest, and therefore the earlier form. The 'wamera' is held in the right hand, and the projecting peg at the end is fitted into a cavity at the end of the spear, which latter is held in the left hand, in the required direction, until just before the moment of throwing. The spear is then impelled to its destination by the wamera, which gives great additional impetus to the arm. Fig. 147 is a wamera from Nicol Bay, of exactly the same general outline as the sword already figured from that locality, figs. 61 and 62, except that one of the faces at the end of which the peg is fastened, is concave, and the other convex; this specimen is in the Christy Collection. The wamera assumes a great variety of forms; some, as for example fig. 142, resemble on a small scale the New Zealand paddle, the broad end being held in the hand, and the peg inserted in the small end; others, broad and flat, figs. 148 to 150, bulge out in the middle by successive gradations, until they approach the form of a shield. No reasonable cause that I am aware of, can be assigned for these different forms; beyond caprice, and the action of the law of incessant variation, which is constant in its operation amongst all the works of the aborigines.

The wamera is found on the north-west[1] and south-west[1] coasts of Australia, and Major Mitchell describes it in the east and central parts of the continent.[2]

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[1] Gregory's account of his expedition in 1861, *Journal of the Royal Geographical Society*, vol. xxxii (1862), p. 378.

That the wamera preceded the bow, appears probable from the fact that no bow is ever used in Australia, unless occasionally upon the north coast, where it is derived from the Papuans. The bow is not indigenous in New Zealand, or in any of those islands of the Pacific which are peopled by the Polynesian race; it belongs truly to the Papuans, and where it is used elsewhere in the Pacific Islands as a toy, it may very probably have been derived from their Papuan neighbours. The throwing stick is used in New Zealand, in which country Mr. Darwin describes the practice with them. 'A cap,' he says, 'being fixed at 30 yards distance, they transfixed it with the spear delivered by the throwing stick, with the rapidity of an arrow from the bow of a practised archer.'[3] In New Guinea, Captain Cook saw the lance thrown 60 yards, as he believed, by the throwing stick.[4] I saw the Australians, now exhibiting on Kennington Common (1868), throw their spears with the wamera nearly 100 yards extreme range, but as they practised only for range, I had no opportunity of observing the accuracy of flight. Mr. Oldfield says that their practice has been much exaggerated by the European settlers, in order to justify acts on their part, which would otherwise appear cowardly. He says, that a melon having been put up at a distance of 30 yards, many natives practised at it for an hour without hitting it, after which an European, who had accustomed himself to the use of this weapon, struck it five times out of six with his spear. Klemm, on the other hand, has collected several accounts of their dexterity in the use of it; he says, that the range is 90 yards, and mentions that Captain Phillip received a wound several inches deep at 30 paces. At 40 paces, he says, the aborigines are always safe of their mark (l. c., p. 32). A sharp flint is usually fixed with gum into the handle of the wamera, which they use for sharpening the points of their spears.

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[1] Oldfield, 'On the Aborigines of Australia,' *Trans. Ethnol. Soc.*, vol. iii. pp. 261–2.

[2] *Expedition to the Interior of Eastern Australia*, by Major T. L. Mitchell, Surveyor-General, *Journal of the Royal Geographical Society*, vol. ii. pp. 325–6.

[3] [Darwin, *Journal*.] (But the quotation (from Darwin, *Journal of Researches* (London, 1845) pp. 433–4) refers to *Australia*, not New Zealand.—Ed.)

[4] Cook, *Third Voyage* (London, 1842), vol. i. p. 273.

The throwing stick (fig. 151) is used by the Esquimaux throughout the regions they inhabit. Frobisher[1] mentions it on the east, Captain Beechey on the north-west, and Cranz describes its use in Greenland.[2] Klemm says (l. c., p. 39), that the throwing stick used in the Aleutian Isles, differs from that of the Greenlander in having a cavity, to receive the end of the spear, instead of a projecting tang. The Esquimaux stick generally differs from the Australian in form, and has usually holes cut to receive the fingers, which by this means secure a firm grasp of the instrument. The custom of forming holes or depressions in an implement to receive the fingers was very widely spread in prehistoric times. I have specimens of stones so indented, used probably as hammers, from Ireland, Yorkshire, Denmark, and Central India. In the Christy Collection there is one precisely similar from the Andaman Isles.

The only other race that is known to make use of the throwing stick is the Purus-Purus Indians of South America, inhabiting a tributary of the Amazon. These people have no bow, and in many other respects resemble the Australians in their habits. Their throwing stick is called 'palheta'; it has a projection at the end, to fit into the end of the spear, and is handled exactly in the same manner as the Australian 'wamera'.[3]

Another kind of spear-thrower, consisting of a loop for the finger and a thong by which it is fastened to the spear, is used in New Caledonia, and Tanna, New Hebrides (fig. 152). On ordinary occasions this is carried by being suspended to an armlet on the left arm, but, when preparing for war, they fasten it on to the middle of their spears. I exhibit here, fig. 153, a precisely similar contrivance from Central Africa, from my collection. Judging by the spiral ferrule, at the end of the lance to which it is attached, it appears to be derived from Central or East Central Africa. This mode of increasing the range of the dart or javelin was well known to the ancients, and was called by the Greeks ἀγκύλη, and by the Romans 'amentum'; it is represented on the Etruscan vases, and is figured in Smith's

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[1] Frobisher, *The Three Voyages of Martin Frobisher*, ed. Collinson (Hakluyt Society, 1867), p. 283.

[2] Cranz, *Historie von Grönland*[2] (1770), pp. 195–6, pl. v. 2 *f*.

[3] Markham, *Tribes of the Valley of the Amazon.—Trans. Ethnol. Soc.*, N.S., vol. iii. p. 183.

Dictionary of Greek and Roman Antiquities, from which the drawing given in fig. 154 is taken.[1] One of the effects produced by this contrivance was, doubtless, to give the weapon a rotary motion, and thereby to increase the accuracy of its flight, upon the same principle as the rifling of a bullet; but the range and velocity were also increased, by enabling the thrower, the tip of whose forefinger was passed through the loop of the 'amentum', to press longer upon the spear, and thus impart a greater velocity to it, in the same manner that the effect of the Australian wamera may be said to increase the length of the thrower's arm. The Emperor Napoleon, who, as we all know, has paid great attention to these weapons of the ancients, caused experiments to be conducted, under his own personal supervision, at Saint Germain, the result of which showed that the range of a spear was increased from 20 to 80 meters by the use of this accessory.[2]

Transition from Club to Shield (Australia).

My next example of variation of form is taken from the Australian 'heileman', or shield. It may, on the first cursory consideration of the subject, appear fanciful to suppose that so simple a contrivance as the shield could require to have a history, or that the plain round target, for example, so common amongst many savage nations, could be the result of a long course of development. Surely, it may be said, the shells of tortoises or the thick hides of beasts would, from the first, have supplied so simple a contrivance. But the researches in palaeo-ethnology teach us that such was not the case; man came into the world naked and defenceless, and it was long before he acquired the art of defending himself in this manner. His first weapon, as I have already said, was a stone or a stick, and it is from one or other of these, that we must trace all subsequent improvements. The stick became a club, and it is to this alone that many of the earliest races trust for the defence of their persons. The Dinkas of East Central Africa have no shields, using the club, and a stick, hooked at both ends (Pl. XVI, fig. 170), to ward off lances.[3] The Shoua and the Bagirmi of Central

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[1] Smith, *Dictionary of Greek and Roman Antiquities* (s. v. Hasta).

[2] Desor, *Les Palafittes ou Constructions Lacustres du Lac de Neuchâtel* (Paris, 1865), p. 87.

[3] Petherick, *Egypt, the Soudan, and Central Africa* (1861), p. 391.

Africa rarely carry shields, and they use a foreign name for it.[1] The Khonds, hill tribes of Central India, have never adopted the shield.[2] The inhabitants of Tahiti use no shield.[3] The Sandwich Islanders use no shield or weapon of defence, employing the javelin to ward off lances: like the Australians, and, like the Bushmen, they are very expert in dodging the weapons of their enemies. In Samoa the club is used for warding off lances, and the warriors frequently exercise themselves in this practice. The 'kerri' sticks of the Hottentots are used for warding off stones and assegais.[4]

The club head formed by the divergent roots of a tree (Pl. XVI, fig. 155), offers great advantages in enabling the warrior to catch the arrows in their flight, and this led to the use of the jagged mace-head form of club, which is here represented from many different localities. Fig. 155 is from Fiji, fig. 157 from Central Africa, fig. 156 from Australia, fig. 158 from New Guinea, and fig. 159 from the Friendly Isles. The curved clubs, of which a great variety are found in the hands of savages in every part of the world, are exceedingly well adapted to catch and throw off the enemy's arrow. The Australian 'malga', or 'leowel', as it is called by the Australians now in this country, and already described (pp. 125–6), is used in this manner.

By degrees, instead of using the club as a general weapon, offensive and defensive, especial forms would be used for defence, whilst others would be retained for offensive purposes; but the shield for some time would continue to be used merely as a parrying instrument. Such it is in Australia. In its most primitive form, it is merely a kind of stick with an aperture cut through it in the centre for the hand. The fore part varies with the shape of the stem out of which it was made; in some it is round, in others flat. This form appears to have branched off into two varieties; one developed laterally, and at last assumed the form of a pointed oval, as represented in Plate XVI, figs. 165 to 169; these are frequently scored on the front with grooves to catch the lance points. The other variety appears to have assumed a pointed form in front, so as to make the spear glance off to one side, as represented in figs. 160 to 164. The Australians are exceedingly skilful in parrying with these shields. One of the feats of the Australians now in this country, consists in parrying cricket balls thrown with full force by three persons at the same time. The 'heileman' is cut out of the solid tree and, like all their other weapons, invariably follows the grain of the wood.

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[1] Barth, l. c., vol. iii. p. 450.

[2] Campbell, *Thirteen Years amongst the Wild Tribes of Khondistan* (London, 1864), p. 40.

[3] Ellis, *Polynesian Researches* (1829), vol. ii. p. 489.

[4] Kolb, *Reise an das Capo du Bonne Esperance* (Nürnberg, 1719), pp. 477–8.

In 1861, Mr. Oldfield, when engaged in collecting specimens of timber for the International Exhibition, came upon one of these shields, nearly finished, and abandoned, but only requiring a few strokes to detach it from the growing tree; and he noticed the immense time and labour it must have cost the native to construct it, not less than 30 cubic feet of wood having been removed in digging it out of the tree with no better tool than a flint fixed to the end of a stick. Trees of sufficient size for these shields are not found in all parts of Australia, and in those places where they are wanting, the natives only obtain them by traffic with other tribes. The same cause may also account, in some measure, for the varieties of their form, yet, notwithstanding these numerous varieties, they never leave the normal type throughout the continent, and you might as well expect to see the Australian using a firelock of native manufacture, as to find in his hands the circular flat shield which is common in Africa, America, and ancient Europe.

Transition from Club to Shield (Africa).

In Africa, the development of the shield appears to have followed precisely the same course, commencing with the plain stick or club, Pl. XVI, fig. 170, and passing through the varieties represented in figs. 171, 172, and 173, which are scarcely distinguishable from the Australian 'heileman', to the oval shield of the Kaffirs, fig. 174, and of the Upper Nile, figs. 175 and 176, which are of ox hide, but show their origin by a stick passing down the centre and grasped in the hand; with this stick they parry and turn off the lances of the assailant precisely in the same manner that the Australian employs the projecting point at the end of his oval shield. Judging by the side views represented in the Egyptian and Assyrian sculptures, similar shields were used by the ancients, and we may especially notice the Assyrian shield, of small dimensions, fig. 178, mentioned by Mr. Rawlinson as being represented in the Assyrian sculptures, and having projecting spikes on the fore part, to catch and throw off the enemy's weapons (*Five Great Monarchies* (1864), vol. ii. p. 51).

Development of the Shield.

All these antique shields have one other feature in common with the shields of existing aborigines, viz. that they are held by a handle in the centre. It was only in a more advanced age, when armies began to fall into serried ranks, that the broad shield was introduced and held upon the left arm, a mode of carrying it ill adapted to the requirements of the light-armed combatants. Besides the oval, the shield took other forms, but appears always to have been narrow in its earliest developments: fig. 176 from the Upper Nile closely resembles in outline fig. 177 from the New Hebrides. Livy describes the shields of the Gauls in the attack of Mount Olympus, B.C. 189, as being too narrow to defend them against the missiles of the Romans, and he also describes them as brandishing their shields in a peculiar manner practised in their original country.[1] This must without doubt have been connected with the operation of parrying. Sir Walter Scott describes the Scotch parrying with their shields. Shields in the form of a figure 8 are met with in various countries; Captain Grant describes the Unyamwezi as carrying a shield of this form.[2] Fig. 179 from this Institution is from Central Africa, of a very primitive form. Fig. 180 is of the same shape from New Guinea, and the beautiful bronze shield, fig. 181[3], of the late Celtic period, in the British Museum, found in the Thames, appears to be of an allied form. Fig. 182 is an ox-hide shield of the Basutos; it is allied to that of the Kaffirs, Fig. 174, by having a stick at the back, and the peculiar wings with which it is furnished connect it with that of the Fans of the Gaboon, on the West Coast, fig. 183, which latter is of elephant hide and has no stick at the back. No connexion that I am aware of is known to have existed between these remote tribes, which are of totally different races, but the forms of their shields here represented must, I think, have been derived from a common source.

[1] Livy, Book xxxviii. ch. 17 and 21.

[2] Grant, *Walk across Africa*, p. 69.

[3] Kemble, *Horae Ferales* (1863), p. 190, pl. xiv.

Concluding Remarks.

It would be quite impossible within the space of a single lecture to produce more than a very small portion indeed of the evidence which is available in support of my arguments. If the principles which I have enunciated are sound, they must be applicable to the whole of the arts of mankind and to all time. If it can be proved that a single art, contrivance, custom, or institution, sprang into existence in violation of the law of continuity, and was not the offspring of some prior growth, it will disprove my theory. If in the whole face of nature there is undoubted evidence of any especial fiat of creation having operated capriciously, or in any other manner than by gradual evolution and development, my principles are false.

It would be a violation of the law of continuity, for example, if the principles which I am now advocating, in common with many others at the present time, opposed as they are to many preconceived notions, were suddenly to receive a general and widespread acceptance. This also, like other offsprings of the human mind, must be a work of development, and it will require time and the labours of many individuals to establish it as the truth, if truth it be.

Meanwhile it may be well that I should briefly sum up the several points which I have endeavoured to prove on the present occasion.

I have endeavoured to prove in the first place, though I must here repeat that I have produced only a very small portion of the evidence on the subject, that all the implements of the stone age are traceable by variation to a common form, and that form the earliest; that their improvement spread over a period so long as to witness the extinction of many wild breeds of animals; that it was so gradual as to require no effort of genius or of invention; and that it was identical in all parts of the world.

I have shown in the second place, that all the weapons of the Australians which I have described, are traceable by variation to the same common form, or to forms equally as primitive as those of the stone age of Europe; that it is perfectly consistent with the phenomena observed, that these variations may have resulted, or at least may have in a great measure been promoted by accidental causes, such as the grain of the wood influencing the shape of the weapon; that they were not invented or designed for especial purposes, but that their application to such purposes may have resulted from a selection of the implements already in hand; and that by this process, the natives of Australia, during countless ages, may have crept on, almost unconsciously, from the condition of brutes, to the condition of incipient culture in which they are now found.

I have compared these weapons of the Australians with others of the same form in various parts of the world, showing grounds for believing that whenever we shall be able to collect a sufficient variety of specimens to represent the continuous progression of each locality, the *modus operandi* will be found to have been everywhere the same.

Lastly, I have alluded cursorily to the analogy which exists between the development of the arts and the development of species. It may be better to postpone any comprehensive generalization on this subject until a much larger mass of evidence has been collected and arranged. Sir Charles Lyell has devoted a chapter in his work on the *Antiquity of Man* to a comparison of the development of languages and the development of species. 'We may compare,' he says, 'the persistency of languages, or the tendency of each generation to adopt without change the vocabulary of its predecessor, to the force of inheritance in the organic world, which causes the offspring to resemble its parents. The inventive power which coins new words or modifies old ones, and adapts them to new wants and conditions as often as they arise, answers to the variety-making power in the animal creation.' He also compares the selection of words and their incorporation into the language of a people, with the selection of species, resulting in both cases in the survival of the fittest (4th ed., 1873, p. 503).

Whilst, however, we dwell upon the analogy which exists between the phenomena of the organic world and the phenomena of human culture, we must not omit to notice the points of difference. The force of inheritance may resemble in its effects the principle of conservatism in the arts and culture of mankind, but they are totally dissimilar causes.

The variety-making power may resemble the inventive power of man; nothing, however, can be more dissimilar, except as regards results.

When, therefore, we find that like results are produced through the instrumentality of totally dissimilar causes, we must attribute the analogy to some prior and more potent cause, influencing the whole alike.

It might be premature to speculate upon the course of reasoning which this class of study is likely to introduce; this much, however, we may, I think, safely predict as the result of our investigation, that we shall meet with no encouragement to deify secondary causes.

Another subject to which we must necessarily be led by these investigations, although, as I before said, it does not fall actually within the scope of my paper, is the question of the unity or plurality of the human race.

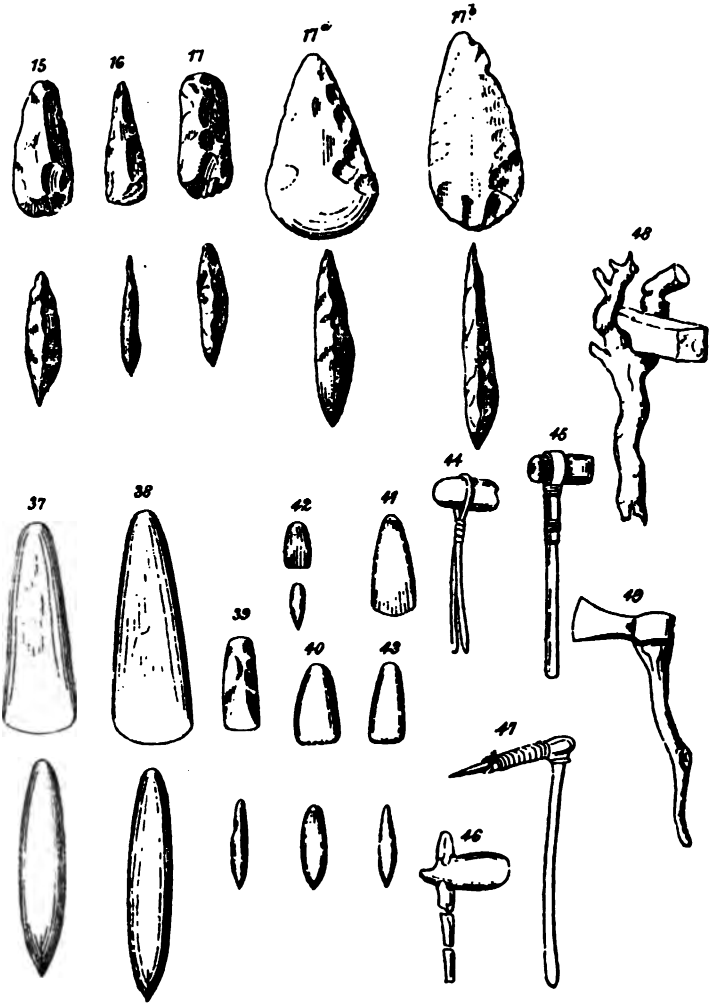
The ethnologist and the anthropologist who has not studied the prehistoric archaeology of his own country compares the present condition of savages with that of the Europeans with whom they are brought in contact. He notices the vast disparity of intellect between them. He finds the savage incapable of education and of civilization, and evidently destined to fall away before the white man whenever the races meet, and he jumps at the conclusion that races so different in mental and physical characteristics, must have had a distinct origin, and be the offspring of separate creations. But the archaeologist traces back the arts and institutions of his own people and country until he finds that they once existed in a condition as low or lower than that of existing savages, having the same arts, and using precisely the same implements and weapons; and he arrives at the conclusion that the difference observable between existing races is one of divergence, and not of origin; that owing to causes worthy of being carefully studied and investigated, one race has improved, while another has progressed slowly or remained stationary.

In this conclusion he is borne out by all analogy of nature, in which he finds frequent evidences of difference produced by variation, but no one solitary example of independent creation. Are not all the branches of a young tree parts of the same organism; and yet one will be seen to throw up its shoots with a vigorous and rapid growth, whilst another turns towards the ground and ultimately decays? Not to mention the variations produced by the breeding of animals, with which we are all more or less familiar, we see under our own eyes families of men diverging in this manner. One branch, owing to causes familiar to us in everyday life, will become highly cultivated, whilst another continues to live on in a low condition of life, so that in the course of a few years the disparity, mental and physical, between these two branches, bearing the same name, will be greater, in proportion to the time of separation, than that which, in the course of countless ages, has separated the black from the white man.

At the present time there is a tendency to rectify these inequalities, whether in regard to our own or to other races, and there can be little doubt that in the course of time, all that remains of the various races of mankind will be brought under the influence of one civilization. But as this progressive movement is often led by men who have not made the races of mankind their study, they are perpetually falling into the error of supposing, that the work of countless ages of divergence, is to be put to rights by Act of Parliament, and by suddenly applying to the inferior races of mankind laws and institutions for which they are about as much fitted as the animals in the Zoological Gardens.

In conclusion, I have only a few words to say upon the defects of our ethnographical collections generally. It will be seen that in order to exhibit the continuity and progression of form, I have been obliged to collect and put together examples from many different museums; and, as it is, it will have been noticed that many links of connexion are evidently wanting. This is owing, in a great measure, to the very short period during which the arts and customs of primaeval races have been made the subject of scientific investigation; but it also arises from the absence of system on the part of travellers and collectors, who in former times appear to have had but little knowledge of the evidence which these specimens of the industry of the aborigines are destined to convey, and who have, therefore, neglected to bring home from the various regions they visited all the varieties of the several classes of implements which each country is capable of affording, thinking that one good example of a tool or weapon might be taken as a sample of all the rest.

PLATE XII.



I am not so presumptuous as to suppose that the particular arrangement, which I have adopted, may not require frequent modification as our evidence accumulates; but I trust that I shall at least have made it apparent to those who have followed the course of my argument, that without the connecting links which unite one form with another, an ethnographical collection can be regarded in no other light than a mere toy-shop of curiosities, and is totally unworthy of science.

Owing to the wide distribution of our Army and Navy, the members of which professions are dispersed over every quarter of the globe and have ample leisure for the pursuit of these interesting studies, this Institution possesses facilities for forming a really systematic collection of savage weapons, not perhaps within the power of any other Institution in the world. The time is fast approaching when this class of prehistoric evidence will no longer be forthcoming. The collection is already what, for this country, must be regarded as a good one, and if I may venture to hope that the remarks I have now the honour of making will be of service in collecting the materials for the improvement of it, I trust it may be thought that my labours and your patience will not have been thrown away.

PRIMITIVE WARFARE

III

ON THE RESEMBLANCES OF THE WEAPONS OF EARLY RACES; THEIR VARIATIONS, CONTINUITY AND DEVELOPMENT OF FORM: METAL PERIOD.[1]

HAVING in two previous lectures upon 'Primitive Warfare', delivered at this Institution, spoken of the general principles to be observed in studying the development of the weapons of savages and early races, I need not preface the remarks I am about to offer by any detailed allusion to the generalizations which I have already ventured to make, but I will proceed at once to lay before you some additional facts which I have collected in continuation of the same subject.

This I do the more readily, because I hold strongly to the opinion that the value of a communication of this kind may, in a great degree, be measured by the attention which is paid to the accumulation of facts, and to the comparative brevity and simplicity of that portion of it which relates to theory. Without general principles, however, we should have no incentive to collect and systematize our facts, and they are therefore valuable even where they involve—and in a new field of study, such as I am now treating, with very scanty materials as yet at our disposal to assist conjecture, I can hardly hope they should not involve—a certain amount of error.

Before entering upon the subject of the origin of metal implements, I must, however, revert to one part of my former communication, in order to show that a statement I then made in reference to the geographical distribution of the boomerang has since had some light thrown upon it by the researches of one of our most eminent men of science. It will, perhaps, be remembered by those who did me the honour of reading my last lecture, which was printed in vol. xii of the *Journal*, that, in describing the weapons of the Australians, I showed, by means of numerous illustrations of the varieties of each class of weapon from that country, that they all passed one into the other by connecting links, so that where a sufficient number of them are arranged in such a manner as to exhibit their continuity, it is often impossible to determine any definite line of separation between them. I also showed that the form of each weapon was determined by the form of the stem or branch of the tree out of which it was made, the outline of all these implements conforming to the grain of the wood; and the inference which I drew from this was, that it showed a very low state of intellect on the part of the constructors, the several classes of implements not having been designed originally for their respective purposes, but produced accidentally, and then applied during subsequent ages to the several uses to which in practice they appeared most suited.

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[1] A Lecture delivered at the Royal United Service Institution on June 18, 1869, and published in the *Journal of the R. U. S. Inst.*, vol. xiii (1869), pp. 509–539, pl. xxxi–xxxiii (= Plates XVII–XX herewith).

As we have no reason to suppose that the Australian continent was peopled at a later date than other parts of the world, and as there is no evidence upon that continent of the people inhabiting it having ever been in a higher state of civilization than they are at present, we have grounds for supposing that they must have remained stationary, or have progressed very slowly, while the inhabitants of other parts of the globe advanced more rapidly, and that their existing arts and implements, simple and primitive though they be, nevertheless represent the highest development of constructive power to which these people have ever attained. Hence it follows, that if the inhabitants of any other portions of the globe can be traced to a common origin with the Australians, viewing the persistency of type observable as a characteristic of the arts of these people, and of all other people in a primitive state of culture, we must expect to find some traces of similar implements in use amongst all such people to whom a common origin can be assigned.

In my last lecture I mentioned that there were three countries in which the boomerang is either still used, or is known to have been used in ancient times, viz. Australia, the Deccan of India, and Egypt, and I also showed some grounds for believing that the same weapon, or something allied to it, may have spread from those countries over Europe, as it is known to have done over a great part of Northern and Central Africa.

Although the comparison of weapons from various parts of the globe can have no other object than to trace out an original connexion, I did not venture to build upon the coincidence of this weapon in these regions, any argument for the common origin of the people by whom it was used. Nor do I think that I should have been justified in assuming such origin upon the grounds of the identity of a single weapon. Such identity may have arisen in three ways:—(1) it may have arisen independently by the spontaneous development of like weapons under similar conditions of life; (2) the weapon itself may have been communicated from some primal source; (3) the races using it may have been themselves derived from a common origin. Of these, the first view, viz. the independent origin of the weapon, would perhaps strike any one at first sight, before having studied the conservatism and persistency of type which is so especially characteristic of savages, as the most probable; it appears so exceedingly simple in its form and uses to our trained and educated minds, that it seems hardly necessary to account for it in any other way; besides which, there are slight differences between the Indian and Australian boomerangs, which have been considered by some to distinguish the two weapons.

I will not here revert to the arguments which I have used to combat this opinion. Suffice to say, that I have since been favoured with much valuable information on the subject by Sir Walter Elliot, who has frequently accompanied the natives of India in their hunting expeditions with this weapon. He says that it is formed on the grain of the wood, like the Australian boomerang, the curve varying with the bend of the stem; it is whirled horizontally, with the end foremost, like the Australian practice, and is used by two tribes in the Deccan, viz. the Kolis of Guzerat and the Marawárs of Madura, but more especially in its simplest form by the former, who are of the Dravidian or black race of the Deccan. In a letter to me he says, speaking of these tribes:—'I have seen both, and, indeed, served ten years in the latter district (Southern Mahratta), where the crooked stick is used by all the lower orders every Sunday during the hot season, when all agricultural labour is at a stand. The villagers turn out in large numbers, and scour the jungle armed with these sticks. Everything that rises is knocked over; deer, hares, birds, even the wild hog and the tiger are occasionally (though rarely, of course) included in the bag. I have seen a line of upwards of 100 men and boys, and the boomerang whirling about in such numbers, and with such precision, that even birds on the wing are brought down. I never met with any regularly formed specimens, except in the South; those in the North were mere angular sticks, of very various form, as natural branches occurred; the favourite form was a rather obtuse angle—nearly a right angle.' Thus, whether we regard the purposes for which it is used, the material of which it is constructed, the manner of throwing, or the varieties of its form, the Indian and Australian boomerang is virtually the same weapon; and I think those who dispute their identity appear rather to have had in view the 'collery stick' of Madras and of the Marawárs than the boomerang of the Kolis.

We may therefore, I think, fairly consider the causes which may have led to the adoption of this weapon as sprung from a common source.

Since my last communication to this Institution, Professor Huxley has given to the world, in a paper read at the meeting of the International Congress of Prehistoric Archaeology—of which I had the honour to be general secretary—in August, 1868, his views 'on the distribution of the races of mankind, as bearing on their antiquity'.[1] The paper created a considerable sensation in the scientific world, owing to the boldness of the generalizations contained in it, and, it may be added, a certain amount of opposition. The accompanying map (Plate XVII) is taken from one drawn by Professor Huxley himself for the Ethnological Society, to illustrate this subject (*Journ. Ethno. Soc.* (1870) N. S. ii. 404–12).

Basing his distribution of the human race on the principle that the characters of the hair and complexion are more permanent, and of greater value as a means of classification, than the bony structure of man, Professor Huxley traces back the numerous varieties of tribes and races into what, for the present, may be regarded as four primary groups.

Commencing, for the convenience of my present subject, with the highest, or those which have shown themselves most capable of development—which, in all probability, is the wrong end of the scale to begin with, if we regarded them in their natural succession—the first of these groups is what he terms the Xanthochroid type (the distribution of which is marked ▒ in the map), a people characterized by yellow hair and fair complexions, with blue eyes, who form a strong element in the composition of the population of this country and a great part of Europe, extending from thence through Scandinavia and Central Europe eastward into Northern India. Next to these he classes the great Mongoloid race (marked by various shades of ▨ on the map), with yellow-brown complexions and black hair and eyes, of which the Kalmucs and Tartars represent the purest types, occupying the whole of Northern Europe and Asia, from Lapland to Behring Strait, and down to the southernmost parts of China; including also the Esquimaux, the Polynesians, and the whole of the inhabitants of the two continents of America. Thirdly, the Negro race (marked ▦ and █ in the map), long headed, with woolly hair, which has its head quarters in all that part of Africa south of the Sahara, but has outlying branches widely detached, and occupying a broken line of islands extending in a belt, from the Andaman Isles in the Bay of Bengal, to the peninsula of Malacca, New Guinea, New Caledonia, and the adjoining isles, and having its southmost limits in the distant island of Tasmania. Lastly, we come to the Australioid race (marked ▓), distinguished by dark chocolate complexions and black eyes, with long heads and soft wavy hair; these the Professor, upon physiological grounds, and after intimate acquaintance with these people in the distant regions in which they are found, traces in three distinct portions of the globe, viz. Australia, the Deccan of India, and Egypt; the three identical countries, it will be observed, in which, unconscious of Professor Huxley's distribution of races, I had traced the occurrence of the boomerang. I think, therefore, it is not an unreasonable conjecture, assuming the correctness of Professor Huxley's premises, that this peculiar weapon may be a relic of the original Australioid stock, which having been originally an effective weapon for all purposes amongst the aborigines of this race, and continuing still to be used as such in Australia, survived in India and in ancient Egypt merely as an implement for the chase and for amusement, much in the same way that, in Europe, bows and arrows have survived amongst children to the present day.

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[1] *Trans. Int. Congr. Prch. Arch. at Norwich*, 1868 (London, 1869), p. 92 ff.

In the remarks which I made (p. 127) upon the varieties of the African boomerang, I drew attention to the peculiarly curved form of the Nubian and Abyssinian sword, and I ventured an opinion that its form may have been originally derived from that of the boomerang, of which weapon a variety, constructed of wood, is still in use by the inhabitants of the country; and I see no reason to doubt that the Abyssinian sword may have been the prototype of those numerous allied forms of iron weapons, the 'hunga-munga', &c., which throughout Africa are still used as missiles, and thrown with a rotatory motion like the boomerang. My conjecture on this subject appears to receive some confirmation from the very peculiar construction of one of these swords, which has lately been added to the museum of this Institution, and which is represented in Plate XIX, figure 1. The angular form of the blade, swelling in the middle, presents such a close affinity to the Australian boomerang, as to strike even those who have not been led, by the considerations I have mentioned, to look for a coincidence in these weapons. I noticed at the same time the very great resemblance between the rudimentary shields of the Australians and those of some of the inhabitants of the valley of the Upper Nile, which may also perhaps be accounted for in the same way. With a view of further connecting this primitive form of shield with similar defensive weapons in India, it is worthy of notice that the hand-shield, having antelopes' horns projecting from it, a representation of which was given in my first lecture, Plate X, figs. 66, 67*a*, and 69 (many of which are furnished with a small iron shield, or guard for the hand, though some are without this accessory), is used—Sir Walter Elliot now informs me—precisely in the same way as the Australian and African parrying-shields, viz. by catching the arrows and darts of the assailant, and parrying them off with the horns, thus favouring the conjecture that I ventured to put forward, that the square, oblong, and circular targets are defensive weapons of comparatively recent origin, being represented in a primitive stage of culture by a simple parrying-stick, derived originally from the club. The club is, as a general rule, the only defensive guard employed by races in the lowest stages of culture. These seem to have been replaced by parrying-sticks, held in the centre, and subsequently hollowed to receive the hand, or furnished with hand-guards, forming rudimentary shields; of which stage in the development of the weapon we are now able to establish connected traces in the three countries under consideration.

If the comparisons which I have made, and the conclusions I have ventured to draw from them, are found to stand the test of further investigation, as it appears to me reasonable to hope they will, the importance of studying the forms and uses of these primitive weapons in connexion with other sociological and biological phenomena, as a means of tracing back the early history of mankind, will be well established. Of this, however, we may feel certain, that if a connexion formerly existed between the inhabitants of India, Australia, and Egypt, the evidence of such connexion will not be limited either to the colour of the hair and skin, or to the resemblance of their weapons, but will be found in other customs and institutions which they brought with them from their fatherland. The important generalizations of Professor Huxley, whether or not they ultimately hold good, have had the good effect of drawing attention to a comparison of the inhabitants of these countries; and though it would be foreign to my present purpose to anticipate the result of these investigations in other branches not immediately connected with my present subject, I may mention that officers acquainted with India and Australia have since pointed out resemblances in the hymeneal and other customs of those countries, which have not before been noticed, but which, when put together and compared, making all due allowance for the variations which are inevitable in the continuous development of all human arts and institutions, will, I doubt not, tend to give confirmation to the theory of races which the author of it has so ably advanced.

Having strayed thus far into the geological and biological aspect of the question, it is necessary to go a step further in order to apply the subject more generally to the origin of weapons, and at the same time to point out some difficulties which stand in the way of accepting this theory of races—difficulties of which Professor Huxley himself appears by his paper to be fully sensible.

The detached portions of the Australioid race are separated from each other by seas of considerable depth, and the same thing applies to the Negroid race. The Australians, he points out, though possessing ample materials for the construction of canoes, have never learnt to make any that are capable of traversing the great seas which separate them from their apparent kindred in other lands, and it is unlikely they should have forgotten the art of navigation if they had once known it. It is inconceivable, therefore, that they should have migrated from Australia to the Deccan, and to Egypt, during the existing geographical arrangement of sea and land, more especially as no trace of such migration is found upon intervening isles. He points out, however, that great geographical changes have probably taken place, and that those changes, in so far as our knowledge of them goes, are of a nature to account for the phenomena observed.

The region of the negro race in Africa is separated from Northern Africa and from Europe by the desert of Sahara, of which there is geological evidence to show that it was sea at a recent geological period. The same applies to the Deccan of India, which is separated from the Himalaya by the great alluvial plains of the Indus and the Ganges, which, having probably formed a strait before the miocene epoch, may have divided the black men inhabiting the Deccan from the Xanthochroid and Mongoloid races to the north. At the same time large tracts now occupied by the sea may then have been land, uniting or connecting by a chain of easily accessible islands the regions in which men of the same colour and physical peculiarities are now found. But it will be seen by the map that the lines of distribution of two of the races, the Negroid and the Australioid, cross each other, and this, according to the theory of migration by land, appears to involve a succession of submersions and upheavals during the human period, which it is difficult to account for.

The distribution of races, according to supposed original distinctions of colour and complexion, will be seized upon by polygenists as an argument in their favour; for it will be said that, according to this theory, the distinctions of race in the earliest times must have been as great, or greater, than they are at present.

There are three ways in which it has been attempted to account for these early distinctions of colour and persistency of type—(1) by supposing the several races of man to have been separately created upon distinct continents of land; (2) by assuming that on each primaeval continent, man was evolved from the anthropoid apes of that continent;[1] or (3), by supposing that these divisions of race, remotely and immeasurably distant though they be, nevertheless carry us only a short way back into the history of man, and that still earlier ages, if we could penetrate them, would show the races of man united.

Now, with respect to the first assumption, that of creation, though we are not, of course, in a position to deny the possibility of it, I confess it appears to me unwarranted by any of the phenomena of nature. We have no knowledge of the special creation of any organized being; and how can we scientifically assume as probable, that, for the probability of which there is no sort of evidence of a nature that inductive science would be warranted in building upon? Continuity and development are seen to be the order of the universe. Man is seen to be, both mentally and physically, amenable to that law; and on what grounds can we assume that he was ever an exception to it? I cannot conceive how those who believe geological changes to have been brought about by causes which are still in operation in our own day, and who make great calls upon time in order to reconcile those causes to the phenomena observed, can, in treating biological phenomena, advocate belief in so great a break in the observed order of the universe as is implied by the special creation of man. Still less willing am I, in the absence of more cogent argument than has ever yet been advanced in support of it, to assent to hypotheses of the separate development of races, which appears to me equally at variance with nature. There can be no doubt that all the existing races of man, whatever their colour and physical peculiarities, have greater affinity to each other than any of them have to the apes, or to any other class of animals. The tendency of progress is from simplicity to complexity, from unity to diversity, and it would be a complete inversion of the order of nature that animals so various as the apes should independently produce animals so much resembling each other as the races of man. The recognized law that, with certain variations, like begets like, appears to me to negative this assumption as fully as it would do the notion, if it were put forward, that because the horse and some other classes of the mammalia, say the rhinoceros, for instance, have some affinities in their bony structure, therefore the black horse is descended from the African rhinoceros, and the white horse from that of India. Moreover, all the races of mankind interbreed, and I am at a loss to understand how a circumstance like this, which throughout the animal kingdom is regarded as a proof of unity of species, should be discarded in its application to humanity. If, then, it is true that diversity of colour is as old as the very earliest traces of man, and there is evidence that the several coloured races were inhabitants of distinct continents, which have disappeared through geological changes dispersing and mixing the races, blending the colours and obliterating the traces of their formerly isolated homes; then to the same causes, which produced the mixing and the blending, we must also attribute the original separation. According to the view I hold, we must ask for more time, and still further geological changes, to bring them together again in the primaeval cradle of the human race.

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[1] *Lectures on Man, his Place in Creation, and in the History of the Earth*, by Dr. Carl Vogt. Edited by James Hunt, Ph.D. (London, 1864), p. 466 ff.

Now, to apply this reasoning to the origin of weapons. The only vestiges of the primaeval tools of mankind now left to us are those constructed of stone; others of the more perishable materials have decayed, and their representatives only have remained in some few cases as survivals. In my last lecture I showed how uniform in shape and in development these stone implements are found to be in all parts of the world, whether derived from the northern or southern continent of America, from Siberia, Australia, India, Africa, or the surface soils and river gravels of Europe. This uniformity of shape has been used as an argument that mankind must have independently designed the same forms of tools in various parts of the world, and that under like conditions, like forms will be produced by men, however remotely separated. I am not prepared to deny the possibility of some of these forms having had an independent origin; but if the proof of it is to be based upon the separation of continents, we see how entirely groundless such an argument is when applied to the earliest ages of humanity. For if, as has been conjectured, the races of man may have been dispersed by geographical changes of land and sea, it is obvious they may have carried with them, from some primal source, the art of manufacturing stone weapons; the resemblance of which is far more satisfactorily accounted for by this means[1] than by supposing such singular and invariable coincidence in design to be the result of independent discovery. As we contemplate man in his lower and lowest conditions, we find the imitative faculty stands out more and more prominently by the absence of those higher qualities which characterize civilized races; and whatever power of originality for the invention of new arts may have been possessed by the earliest inhabitants of the globe, its results appear to have been spread over so vast a lapse of time that it can scarcely be accounted at all as an element in the mental attributes of primaeval man.

I now pass to what has been announced as the subject proper of my present communication, viz. the origin and development of metal tools. I use the word *metal* intentionally, in preference to specifying bronze, because, although we have good reason for supposing that in Europe, Egypt, Assyria, and the central parts of America, bronze preceded iron as a material for weapons, it is not so certain that this was the case in all parts of Asia; and in Africa we know that iron was the first metal employed by the negroes.

Perhaps no subject has given rise to so much difference of opinion amongst archaeologists as this question of the origin of metal implements, or has been accompanied with such uncertain results, owing to the great mass of conflicting evidence to be dealt with, and the great doubt which rests upon much of it, whether in regard to the casual mention of the subject in ancient authors, or to the often ill-directed researches of modern times. It would be hopeless, in the brief time allotted me on the present occasion, to attempt to throw fresh light on this intricate subject, even if I possessed the materials for so doing. All I shall endeavour to do is, to put together, in as intelligible a form as possible, some of the more salient points upon which archaeologists are divided, and trace the continuity observable in passing from the stone to the metal age.

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[1] The fact mentioned both by the Baron de Bonstetten and Dr. Keller, of celts of jade and nephrite having been found in Switzerland, materials which, according to the latest investigations [1869], are not found in the Alps, but must have been imported from the East, proves that intercommunication and barter must have been carried on between distant countries at the time when such weapons were used.—Baron de Bonstetten, *Recueil d'Antiquités Suisses* (Berne, 1855), p. 12; Keller, *The Lake Dwellings of Switzerland* (1866), pp. 56, 68 (cf. 1878, pp. 72, 195, 205, 215).

We have already seen, in speaking of the implements of the stone age, a gradual improvement in form and fabrication, developing itself in proportion as the wild animals which were contemporaneous with the first traces of man in Europe became extinct, partly, no doubt, through the efforts of man himself in exterminating them, and partly, as there seems reason to suppose, owing to an alteration of temperature, rendering the climate unsuited to the constitution and habits of those animals, which therefore migrated by degrees, and the majority of which are now found chiefly, though not exclusively, in arctic regions. Thither they have been accompanied by races of men whose arts and implements show them to be very nearly in a corresponding stage of civilization to the early races, the relics of which are found associated with the same animals in Europe. The simultaneous migration of races of men in the hunting stage of civilization, with the animals, the pursuit of which forms the almost sole occupation of their lives, is well shown in the case of the North American Indians, whose geographical distribution is now almost identical with that of the buffalo. This forms a strong point in the arguments of those who are disposed to attribute all the changes in the world's civilization to the influx and extermination of antagonistic races. But it must be remembered that progress advances in an increasing ratio, and the phenomenon now seen in America and Australia of a highly civilized race constantly fed by steam-communication from the Old World, driving before it and rapidly exterminating other races so vastly its inferior as the Australians and American Indians, is one which could have had no parallel at the early period of which I am now speaking. We must here look for a slower process, though doubtless the operating causes may, to a great extent, have been the same.

The fabrication of stone implements would of itself lead by degrees to a knowledge of the metals which are contained in stones. Thus, for example, I have here a specimen of a stone mace-head from Central America, figure 2, Plate XIX, composed of a nodule of haematite partially coated with micaceous iron ore, the particles of which are distinctly visible on its glittering surface. The weight of this implement, being nearly double that of a mace-head composed of ordinary stone, would at once attract the notice of the savage fabricator, and lead him to investigate the uses of metal.

But, as a general rule, races engaged exclusively in hunting, who rarely turn their attention to the ground except to examine a trail or to search for water, would have little opportunity of profiting by the mineral wealth of the soil over which they roamed. Witness the Australians, who have continued for ages in ignorance of the gold and other mines which are now so attractive to Europeans; or the North and South American Indians, and the Esquimaux, amongst whom the art of smelting metal has never been found associated with those races who are in a purely hunting stage of existence; the wrought metals used by such races to point their weapons being invariably derived from civilized sources.

From hunting wild animals, the savage, in the natural sequence of progress, would turn his attention to their capture and domestication, and thus he creeps gradually into the pastoral life; and as the bones of animals under domestication, through want of exercise and good living, become smoother and of finer texture, the experienced anatomist is thereby afforded the means of distinguishing, amongst the vestiges of antiquity, the remains of domesticated animals from those derived from the chase, and of observing to what extent the domestication of animals was contemporaneous with other changes in the social condition of the people.[1] Still, however, in the pastoral state, the barbarian is not necessarily brought in contact with metals; and hence we should expect in many cases to find the traces of domesticated animals associated with people who are still in the stone age. This was notably the case amongst the ancient inhabitants of the Swiss lakes, where the sheep and horse have been found at Moosseedorf, and other lake habitations which are proved to belong to the stone age, though not in such abundance as in the settlements belonging to the bronze age.[1]

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[1] *Prehistoric Times*, by Sir John Lubbock, Bart., F.R.S., London (1865), p. 147.

From the pastoral life, the barbarian, hampered by his flocks and herds, and no longer obliged to wander in search of food, settles down to a more stationary life, and by degrees takes to agriculture. Then, for the first time, he digs into the soil, and becomes acquainted with its mineral treasures. It has been proved by the discovery of quantities of carbonized grains of wheat, lumped together, in the Swiss lake-habitations of the stone age, together with the materials for preparing it for food, that a knowledge of agriculture preceded the general employment of bronze in that region,[2] whilst in Britain, and in Denmark also, bronze is almost invariably associated with evidence of domestication and agriculture.

The metals first employed would be those that are most attractive. Copper, in Europe, from the bright colour of its ores, would be noticed more readily than iron, which is often scarcely distinguishable from the soil, and requires greater temperature and more skilled labour to render it available than could be expected of a people emerging out of the savage state. It is not, therefore, surprising that in Europe, copper first, and subsequently its alloy, bronze, should have been employed before iron as a material for weapons. But in those countries where iron is found upon the surface in an attractive form, and in a condition to be easily wrought, we must for the same reason suppose that it would be used instead of copper in the earliest ages of metallurgy.

It is natural to suppose that, in the ordinary course of development, an age of pure copper must have intervened between the ages of stone and bronze. But implements of pure copper are comparatively rare, bronze being the metal almost invariably found following immediately upon the age of stone.[3] Notwithstanding the comparative rarity of copper tools, however, there is reason to believe that this metal was used in a pure state before the discovery of the alloy. According to Professor Max Müller, copper was the metal spoken of by Hesiod and Homer as the material generally employed for weapons in their time.[1] Mr. Rawlinson, in his *Five Ancient Monarchies*, says that the metallurgy of the early Chaldeans was of a very rude character, indicating a nation but just emerging from an almost barbaric simplicity, and that copper often occurs pure.[2] Copper implements, of a very early form, beaten into shape, occur not unfrequently in Ireland, as may be seen by specimens represented in Class A, Plate XVIII. They have also been found in Mecklenburg and in Denmark, and Klemm[3] says that they occur in Greece, Italy, Spain, Egypt, and Hindustan. At Maurach, in Switzerland, a copper celt was found in a lake dwelling, which Dr. Keller, notwithstanding this circumstance, attributes to the stone age.[4] In the lake dwelling of Pescheira, on the lake of Garda, several copper implements were discovered,[5] and in certain localities in Hungary copper implements are said to be as plentiful as those of bronze.[6] An axe of pure copper was discovered in Ratho Bog, near Edinburgh, under 20 feet of stratified sand and clay, and Dr. Wilson mentions that others have been found in Scotland.[7] Copper implements occur in Peru, to prove that, in the central parts of America also, the manufacture of bronze was preceded by the use of copper in a pure state; and in the ancient mines of Lake Superior we have distinct evidence of a stage of early metallurgy in which copper was used simply as a malleable stone, and beaten out into the form of implements without the aid of any alloy or a knowledge of the process of casting.[8] (See Plate XIX, figures 3, 4, 5, and 6.) When it is considered that without the admixture of a small portion of alloy of zinc or tin, copper is very difficult to melt, and can only be used by a laborious process of beating into form, and also what a great superiority bronze has over copper as a cutting material, whilst at the same time the process of fabrication is actually in some degree facilitated by the addition of tin, it is not surprising that on the first discovery of the advantages of this mixture, all the old implements of copper, wherever procurable, should have been taken to the melting-pot for conversion into bronze, and we should thus be left with such scanty evidence of the existence of an age of copper.

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[1] *Prehistoric Times*, by Sir John Lubbock, Bart., F.R.S. (1865), pp. 142–3; *Results of the Investigation of Animal Remains from the Lake Dwellings*, by Prof. Rütimeyer; in *The Lake Dwellings of Switzerland*, by Dr. Ferdinand Keller, translated by J. E. Lee, F.S.A., F.G.S., 1866, pp. 355–62 (1878, pp. 537–44).

[2] *Moosseedorf*, Keller, l. c., p. 35; *Robenhausen*, Keller, l. c., p. 40.

[3] (The first two sentences of this paragraph have been transposed, for clearness.—Ed.)

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[1] Max Müller, *Science of Language*, second series (London, 1864), p. 230.

[2] Rawlinson, *The Five Great Monarchies of the Ancient Eastern World* (1864), vol. i. p. 123.

[3] Klemm, *Werkzeuge und Waffen* (Sondershausen, 1858), p. 96.

[4] Keller, l. c., p. 116 : (1878, p. 121).

[5] Keller, l. c., p. 221, pl. lxvii : (1878, p. 362, pl. cxix).

[6] Keller, l. c., pp. 218, 219, pl. lxviii : (1878, pp. 362–3, pl. cxx. 1–28).

[7] Wilson, *Prehistoric Man* (London, 1862), vol. i. p. 282.

[8] Wilson, *Prehistoric Man*, vol. i. pp. 231–79 ; Squier and Davis in *Smithsonian Contributions to Knowledge*, vol. i. pp. 196–203, figs. 81, 82, 84, 87.4, 87.1, from which work the illustrations are taken.

Up to this point we meet with no difficulty in supposing that the use of metal may have been at first adopted by many nations independently, without intercourse one with another. But when we find in both hemispheres of the globe a very wide diffusion of weapons of bronze, consisting of a mixture of the same metals, which, though varying slightly in its proportions, as we shall afterwards see, is nevertheless, for the most part, constant in its adherence to a standard of about nine parts copper to one of tin in all parts of the world, the question arises whether the knowledge of this mixed metal could have been arrived at independently in different countries, or whether it must have been diffused all over the universe from a common source. It is true that copper and tin materials are sometimes found in the same locality, as, for instance, in Cornwall, the locality which, from the remotest time up to the present, has afforded the most plentiful supply of both metals perhaps in the world. We have evidence, also, that in ancient copper mines fire was employed by the miners for softening the metal and detaching it from the matrix,[1] and it is, therefore, highly probable that the admixture of the two metals occurring so close together, and a knowledge of the advantages accruing therefrom, may have been brought about accidentally in the process of mining.[2] But this connexion of the metals in a state of nature is not common, and in those countries, such as Denmark and Scandinavia, where bronze implements occur, and in which neither metal is found native, it is most improbable that the inhabitants should have discovered the merits of these particular ingredients, unless they had derived the knowledge of them from without.

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[1] Wilson, *Prehistoric Man*, vol. i. p. 253.

[2] Since the above was written, Sir John Lubbock has published in an Appendix to his second edition of *Prehistoric Times* (1869), p. 595, letters from Dr. Percy, and from Messrs. Jenkin and Lefeaux, highly experienced assayers, expressing their opinions upon the theory of M. Wibel, that the ancient bronze was obtained, not by the fusion of copper and tin, but directly from ore containing the two metals. They are unanimously of opinion that this could not have been the case, none of the ores containing naturally a mixture of the metals in proper proportions. Although the opinions of these gentlemen appear decisively to negative the possibility of ancient bronze having been

Hence we find archaeologists as much divided in their opinions upon what I may call the monogenesis or polygenesis of bronze, as biologists and anatomists are upon the monogenesis or polygenesis of the human race. The same question repeats itself again and again in dealing with the vestiges of the early history of man, and we may therefore divide the consideration of this question of the origin of bronze under pretty nearly the same heads to which I have adverted when speaking of the distribution of races, and of the age of stone (pp. 147–54). The questions to be considered may be numbered as follows:—(1) that bronze was spread from a common centre by an intruding and conquering race, or by the migration of tribes; (2) that the inhabitants of each separate region in which bronze is known to have been used discovered the art independently, and made their implements of it; (3) that the art was discovered, and the implements fabricated, on one spot, and the implements disseminated from that place by means of commerce; (4) that the art of making bronze was diffused from a common centre, but that the implements were constructed in the countries in which they are found.

Amongst the advocates for the first hypothesis, viz. introduction by the intrusion of fresh races, are to be found chiefly the Scandinavian archaeologists, amongst whom may be especially mentioned Professors Worsaae, of Copenhagen[1], and Nilsson, of Stockholm. Both metals are foreign to the soil of Denmark, and must, therefore, have been imported. In the graves, bronze weapons are in Denmark invariably found with burials by cremation, while those of the stone age are by inhumation, the former being recognized, in an early stage of civilization, as a later process than burial by inhumation. Bronze is here markedly

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habitually produced for commercial purposes in this manner, they do not appear to me to discredit the supposition that the first imperfect knowledge of the mixture may have been brought about accidentally in the manner I have described.

[1] Worsaae, *The Primeval Antiquities of Denmark* (London, 1849), pp. 24, 40–45.

associated with traces of agriculture, the evidence of which is wanting in the stone age. The age of bronze, it is asserted by these antiquaries, was ushered in in Denmark by the employment of implements showing the highest perfection of art, and at a later period, when they are associated with weapons of iron, they are inferior in the quality of their workmanship. The weapons of bronze have remarkably small handles, denoting a smaller race, and hypothetically an eastern origin, small handles being to this day the characteristic of weapons from India. Some of the bronze spear-heads in Denmark have been found with nails driven into them, a practice which still exists in India, each nail denoting a victim; and in the Asiatic islands the custom of boring a hole in the weapon for each victim is found to the present time.[1] The peculiar ornamentation so often found on the bronze swords of Denmark, known as the spiral ornament, is said, though I think erroneously, to be of Phoenician origin. To these and other arguments for the introduction by intruding races, Professor Nilsson adds, that in the countries of the north, where bronze implements are found in greatest abundance, the graves in which they occur are usually situated in groups, proving that bronze was introduced, not by isolated individuals, merchants, or travellers, but by tribes or colonies more or less numerous, occupying especial tracts of country.

The theory of race-origin is also not without its adherents in this country. Dr. Thurnam, who has excavated a large number of barrows in the south of England, divides them—as, indeed, they have been divided by former antiquaries—into several classes, amongst which we may chiefly distinguish two principal types, viz. the long and the round barrows. The former he attributes to the stone age, containing usually implements of that material, whilst implements of bronze are almost invariably found in the round barrows. He also gives it as the result of his researches, extending over some years of exploration—and Canon Greenwell, in so far as his experience of long barrows in the north of England goes, confirms the statement—that the long barrows are generally associated with dolichocephalic, or long skulls, whilst in the round barrows brachycephalic, or round skulls, are found, thus leading to the supposition that the long-headed people of the stone age who erected the long barrows may have been succeeded by another race with round heads importing bronze, and burying their dead in round barrows. But after having heard Dr. Thurnam's last papers on this subject, read before the Society of Antiquaries and other societies[1], I confess, although he has no doubt established a sequence, that he does not appear to me to have determined a clear line of separation between the two classes of interments; the long barrows pass by intermediate links into the round ones, and the long skull, although no doubt it may be considered characteristic of an earlier period, and therefore connected with an earlier form of barrow, also passes by gradations into the round skull, the variations of form being considerable. Then, with respect to the implements, although the absence of bronze in the long barrows of the earlier period appears to be determined, yet it is notorious to all those who have paid attention to the subject—and is not by any means denied by the learned antiquaries whose names I have mentioned—that the transition from stone to bronze in this country was gradual, and extended over a long period, flint weapons being found in nearly all the barrows of the bronze age in such positions as to show they were used contemporaneously by the same people; and from discoveries which have been made both by myself and others[2], there seems good reason to suppose that flint weapons continued to be used by some of the inhabitants of this country even during the Roman era. This distinction of long heads in long barrows, and round heads in round barrows, is one so easily remembered, that it is liable on this account, perhaps, to receive greater attention than it really deserves as a criterion of race. The difficulty of distinguishing in all cases the primary from the secondary interments in the barrows—it being an established fact that these barrows were used as places of burial by successive generations, and even perhaps by successive races, including also the Anglo-Saxons—the possible distortion of some of the crania by time and pressure, and the other facts of the case, as I believe I have correctly stated them, are, I think, sufficient to justify us in withholding for the present our entire acceptance of the theory of the introduction of bronze into this country by intruding races, as drawn from any evidence derived from the graves.

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[1] The custom of making a mark upon the weapon for each victim slain, is one of very usual occurrence among savage people.

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[1] Thurnam, *Ancient British Barrows* (1869), pp. 168, 198; *Archaeologia*, vol. xlii; 'On the Two Principal Forms of Ancient British and Gaulish Skulls,' *Mem. Anthrop. Soc. Lond.*, i. 120 ff., 459 ff. (1865); iii. 41 ff. (1870); Davis and Thurnam, *Crania Britannica* (London, 1865).

[2] 'On some Flint Implements found associated with Roman Remains in Oxfordshire and the Isle of Thanet,' by Col. A. Lane Fox, *Journal of the Ethnological Society* (1869), N.S., vol. i. p. 1 ff.

From amongst those who have advocated the totally independent origin of bronze, the opinion of Professor Daniel Wilson may be selected, as affording a most ingenious argument derived from an analysis of the metals.[1] He quotes some experiments conducted by Dr. George Pearson, and communicated by him to the Royal Society of London in 1796, to ascertain the results of various proportions of the ingredients of tin and copper in bronze. 'Having fused these metals in various united proportions, commencing with 1 part of tin to 20 parts of copper, which produced a dark-coloured bronze, he reduced the proportion gradually to 15 parts of copper to 1 of tin, when the colour was materially affected, and the red copper hue was no longer seen, but an alloy of greater strength was produced. The experiments were continued with 12, 10, 9, 8, and 7 parts of copper to 1 of tin, and when the last fusion of the metals was tested, increased hardness and brittleness of the metals became very apparent. The same characteristics were still more marked on successively reducing the proportions of copper to 6, 5, 4, and 3; and when alloy was made of 2 parts of copper to 1 of tin, it was, according to Dr. Pearson's report, as brittle as glass.'

From the result of these experiments we see that the best average proportions, of about 9 parts of copper to 1 of tin, would invariably show itself by a practical experience in the use of these ingredients, and it is therefore unnecessary to assume that these particular proportions, when found in the bronzes of different countries, must necessarily have been communicated.

Dr. Wilson then proceeds to give the results of analyses of ancient bronzes discovered in Europe, America, and elsewhere, contained in the accompanying tables. And he concludes his observations on the subject as follows:—

'From the varied results which so many independent analyses disclose, varying, as they do, from 79 to 94 per cent. of copper, or more than the total amount of the supposed constant ratio of tin, besides the variations in the nature, as well as the quantity of their ingredients' (a proportion of lead will be seen in some of the analyses of European bronzes, the small proportion of iron being probably accidental), 'it is abundantly obvious that no greater uniformity is traceable than such as might be expected to result from the experience of isolated and independent metallurgists, very partially acquainted with the chemical properties of the standard alloy, and guided for the most part by practical experience derived from successive results of their manufacture.' The comparison of the two tables here given, from Professor Wilson's work, also shows a smaller average amount of tin in the American bronze (Table I) than in that of ancient Europe (Table II).

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[1] *Prehistoric Man*, by Daniel Wilson, LL.D. (London, 1869), vol. i. p. 308.

TABLE I.—ANALYSES OF ANCIENT AMERICAN BRONZES

Object.	Locality.	Observer.	Copper.	Tin.	Iron.
1 Chisel from Silver Mines	Cuzco .	Humboldt . .	94.0	6.0	
2 Chisel " "	Cuzco .	Dr. J. H. Gibbon	92.385	7.615	
3 Knife " "	Atacama	J. H. Blake, Esq.	97.870	2.130	
4 Knife.	. .	Ditto	96.0	4.0	
5 Crowbar.	Chili. .	Dr. T. C. Jackson	92.385	7.615	
6 Knife.	Amaro .	Dr. H. Croft. .	95.664	3.965	0.371
7 Perforated Axe . . .	. .	Ditto	96.0	4.0	
8 Personal Ornament . .	Truigilla	T. Ewbank, Esq.	95.440	4.560	
9 Bodkin from Female Grave	. .	Ditto	96.70	3.30	

This argument, however, is defective when taken to determine the question of the origin of bronze in favour of independent discovery, for we have already seen, in speaking of the stone age,—and I have endeavoured to show that it is a peculiarity observable in the works of all savage and barbarous races,—that being devoid of rule or measure, and having very imperfect means of securing adherence to a uniform standard, their productions are characterized by incessant variations, even in cases where the first idea is known to have been derived from a common source. The variations here shown to exist in the composition of bronze are no greater than are capable of being accounted for by the universal prevalence of a law of variation,

Table II.—Analyses of Ancient European Bronzes

Object.	Locality.	Observer.	Copper.	Tin.	Lead.	Iron.
1 Lituus	Lincolnshire	Dr. G. Pearson, F.R.S., Phil. Trans.	88·0	12·0		
2 Anglo-Roman Patellae	. . . . . .	Ditto ditto	86·0	14·0		
3 Spear-Head	. . . . . .	Ditto ditto	86·0	14·0		
4 Scabbard	Danish ?	Ditto ditto	90·0	10·0		
5 Axe-Head	Ireland	Ditto ditto	91·0	9·0		
6 Axe-Palstave	Cumberland	Ditto ditto	91·0	9·0		
7 Axe-Head	. . . . . .	Ditto ditto	88·0	12·0		
8 Bronze Vessel	Cambridgeshire	Professor Clark, M.D.	88·0	12·0		
9 Sword	France	Mongez, Mémoires de l'Institut	87·47	12·53		
10 Caldron	Berwickshire	G. Wilson, M.D., Prehist. Ann. Scot.	92·89	5·15	1·78	
11 Sword	Duddingstone	Ditto ditto	88·51	9·30	2·30	
12 Kettle	Berwickshire	Ditto ditto	88·22	5·63	5·88	
13 Axe-Head	Mid-Lothian	Ditto ditto	88·5	11·12	0·78	
14 Caldron	Duddingstone	Ditto ditto	84·8	7·19	8·53	
15 Palstave	Fifeshire	Ditto ditto	81·19	18·31	0·75	
16 Sword	Ireland	Professor Davy, Prehist. Ann. Scot.	88·63	8·54	2·83	
17 Sword	. . . . . .	Ditto ditto	83·50	5·15	8·35	3·0
18 Sword	Thames	J. A. Phillips, F.G.S., &c.	89·69	9·58	. .	0·33
19 Sword	Ireland	Ditto	85·62	10·02	. .	0·44
20 Celt	. . . . . .	Ditto	90·68	7·43	1·28	
21 Axe-Head	. . . . . .	. . . . . .	90·18	9·81		
22 Axe-Head	. . . . . .	Ditto	89·33	9·19	. .	0·33
23 Celt	. . . . . .	Ditto	83·61	10·79	3·20	0·58
24 Celt	King's County, Ireland	Dr. Donovan, Chem. Gazette	85·23	13·11	1·14	
25 Drinking-Horn	. . . . . .	. . . . . .	79·34	10·87	9·11	
26 Bronze Vessel	Ireland	Mr. Gibbon, U. S. Mint	88·0	12·0		
27 Wedge	. . . . . .	Ditto	94·0	5·9	. .	0·1

resulting from many causes, and amongst others from want of precision, and carelessness, which is a defect common alike to all tyros in their art, whether ancient or modern. It is a fault we have many of us to complain of almost daily in our cooks. A batter pudding is composed of milk, flour, and eggs, in proper proportions, but a careless cook will constantly vary her proportions, and will fail in adjusting her quantities to the total amount; but we must not, on that account, assume that each cook has invented the art of making batter puddings independently. So, in like manner, it is quite consistent with the facts observed even in America, to suppose that the first knowledge of bronze, and of those many features in the civilization of the Mexicans and Peruvians which present such striking analogies to the civilization of Egypt, may have been originally communicated by some casual wanderer or some shipwrecked castaway from the then centres of Eastern culture (for the theory of geographical changes is, of course, out of the question when speaking of the origin of bronze), and that they have varied in their development on American soil no more than might naturally be expected from their introduction to an entirely new and partially civilized race. Such an assumption, though difficult to account for, and wanting in evidence, is more in accordance with the well-known traditions of the Mexicans and Peruvians, who attribute their civilization to the advent of a god; or with that of the natives of Nootka Sound, on the north-west, who state that an old man entered the bay, in a copper canoe, with paddles of copper, and that the Nootkans by that means acquired a knowledge of that metal.

As illustrations of the modern metal-work of the natives of Nootka Sound and its neighbourhood, several examples are given in Plate XIX, figs. 7 to 11. Figures 7 and 8 represent two sides of an iron dagger in the Museum of the Royal United Service Institution. The ornamentation on the handle is that of the natives of the country, but the workmanship of the blade, which is ribbed on one side, appears to indicate foreign manufacture. Figures 9 and 10 are two sides of a copper dagger of the same form; this specimen is now in the Belfast Museum, in which it was deposited in the year 1843 by Mr. A. Thompson, who brought it from the north-west coast of America, and described it as having been fabricated by the Flathead Indians; it is undoubtedly of native workmanship; in both these weapons one side of the blade and handle is concave, the other convex, a form which appears to denote that it was originally taken from some similar weapon of bone or cane. The nearest approach to the form of this weapon in bone, that I am aware of, is that of the Indian 'kandjar', a figure of which was given in my first lecture on Primitive Warfare, Plate X, fig. 63. This weapon has also one concave and one convex side, derived from the natural curvature of the bone out of which it is made.

But putting aside American civilization, which, it must be admitted, does in the existing state of our knowledge present great difficulties in the way of those who advocate the theory of a common origin for bronze, and turning our attention to the eastern hemisphere, we find the evidence on this point more satisfactory. We may observe, in the first place, that the area over which bronze has been used for implements appears, in so far as we have at present been able to trace it, to be continuous, extending over the greater part of Europe, Egypt, Assyria, and some parts of Siberia, India, and China, from which latter country some few bronze weapons have lately been added to the British Museum. Mr. Theobald, of the Geological Survey of India, also mentions in a paper read to the Bengal Asiatic Society,[1] that bronze axes are found in the valley of the Irrawaddy, where they are held in such veneration as rarely to be procurable; and Sir Walter Elliot has shown me some bronze implements which he found deep beneath the soil in cutting a canal in the valley of the Ganges. Bronze is wanting in Africa; in America, with the exception of Peru and Mexico; in the north of Sweden and Norway, and, I believe, in the greater part of the northern districts of Russia and Siberia, though with regard to Russian and Siberian bronzes, our information is still very deficient. And here I may observe that I speak only of bronze as applied to tools and weapons; its use for other purposes may have been introduced at any subsequent period of the world's history; but the presence of a bronze weapon implies either total ignorance, or at least an imperfect knowledge of the means of hardening the more useful metal for this purpose, iron.

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[1] *Proceedings of the Asiatic Society of Bengal*, 1865, p. 126.

Those who wish for more detailed information as to the evidence upon which the succession of the stone, bronze, and iron ages has been determined, would do well to refer to Sir John Lubbock's remarks upon this subject in *Prehistoric Times*. It may, however, be useful to enumerate briefly some of the chief points which have been adduced in support of the opinion that the employment of these materials corresponds to successive stages in the development of civilization in Europe. (1) Not only do the Roman writers mention iron as being the metal used by them in their time, but they also speak of its employment by the barbarian nations of the north, with whom they came in contact, and the word 'ferrum', *iron*, was with the Romans synonymous with sword. (2) Although numerous finds of iron implements of the Roman period have been discovered in various parts of the world, there has been no authentic and undoubted instance of a weapon of bronze having been found associated with them, or with Roman pottery or coins. (3) Bronze implements are most abundant in Denmark and Ireland, countries which were never invaded by Roman armies, whilst they are exceedingly rare in Italy. (4) The ornamentation of the bronze implements is not Roman, but pre-Roman in character. (5) On the other hand, the numerous finds of bronze weapons which have been discovered have never been associated with iron, except in cases where the nature of the iron implements shows them to have belonged to a period of transition. (6) The pottery associated with bronze-finds is superior to that found with stone implements, but inferior to that of the iron age, and the potter's wheel was unknown during the stone and bronze ages. (7) Silver is found associated with iron, but rarely if ever with stone or bronze. (8) No coins or inscriptions of any kind have been found with bronze implements. (9) In the Swiss lakes, settlements associated with stone and bronze have been found near each other, as for instance Moosseedorf and Nidau, 15 miles apart; in the former, bronze is entirely absent; in the latter, it was used not only for articles of luxury, such as might denote a more wealthy class, but also for implements of common use, such as fish-hooks, pins, &c.; it is improbable that so marked a contrast in the civilization of two settlements so close to each other should have existed during the same period. (10) The implements and ornaments of the bronze-finds are more varied in form, showing an advance in art upon those appertaining to the stone age. (11) The bronze-finds are marked by an increase in the number of domesticated animals, and an entire absence of some of the wild animals of the earlier period, and they are also more clearly associated with traces of agriculture. (12) In the Danish peat bogs, successive strata are found overlying each other, denoting changes in the vegetation of the country; in the lowest and earliest are found the remains of pine trees, which now are foreign to the soil; above which are strata in which oak was the prevailing tree, and at the present time the oaks have been superseded by beeches. These successive strata correspond in a general way to successive stages in the civilization of the inhabitants; in the pine-bearing strata, implements of stone are found; with the oak trees, implements of bronze, and higher up, implements of iron. It has also been attempted to trace a somewhat similar succession of periods in the gravels and alluvium of the torrent of Tinière, in Switzerland; but the evidence in this case is not considered so satisfactory as in that of the Danish peat bogs.

In Chaldea, the transition from stone to bronze has been traced by the relics found in the soil; iron being then used only in small quantities, and chiefly for ornaments, as amongst the ancient Britons in the time of Caesar.[1] In Egypt, where both bronze and iron weapons have been found in the tombs, the transition from bronze to iron is marked by the colour of the weapons in the paintings, and dates, according to Sir Gardner Wilkinson, about B.C. 1400. Hesiod speaks of an age of copper, when the 'black iron did not exist'. Homer also alludes frequently to copper or bronze implements, and when iron is mentioned always speaks of it as requiring much time and labour to fabricate it. Then we have the well-known passage from Lucretius, so often quoted in reference to this subject, in which the three ages of stone, bronze, and iron are mentioned;[1] and Strabo mentions the Lusitanians as being armed partly with copper or bronze weapons.[2]

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[1] Rawlinson, *Five Great Monarchies* (1864), vol. i. p. 120.

Many other quotations might be given from ancient authors to prove that the existence of a bronze age preceding the use of iron was known to the ancients, but I will not occupy your time further with this part of the subject, seeing that others far more competent to deal with it than myself have failed to derive much information of value from this source. There is often considerable difficulty in determining the exact meaning of the writers, when speaking of the material of which weapons are composed, the same word being sometimes used to express copper, bronze, and iron. In fact it may, I think, safely be said that, notwithstanding the large amount of useful information that may be obtained from the study of the early writers, there is no more fruitful source of error than the attempt to apply ancient history and tradition to the elucidation of prehistoric events. Modern science, and our fuller appreciation of the value of evidence, have thrown far more light on prehistoric times than ever fell to the lot of the ancients; and it is for us, therefore, to correct their errors, and not to be misled by them.

Professor Max Müller, in the second series of his *Science of Language*, has, however, drawn some important conclusions on this subject, from the etymology of words representing metal, of which it may be useful here to give a brief abstract. Quoting Mr. E. B. Tylor's work on the Anahuac (p. 140), he says: 'The Mexicans called their own copper or bronze *tepuztli*, which is said to have meant originally *hatchet*; the same word is now used for iron, with which the Mexicans first became acquainted through their intercourse with the Spaniards. *Tepuztli* then became a general name for metal, and when copper had to be distinguished from iron, the former was called red *tepuztli*, and the latter black *tepuztli*. The conclusion,' he says, 'which we may draw from this, viz. that Mexican was spoken before the introduction of iron into Mexico, is one of no great value, because we know it from other sources'; but applying the same line of reasoning to Greek, he says, 'here, too, *chalkós*, which at first meant copper, came afterwards to mean metal in general, and *chalkeús*, originally a copper-smith, occurs in the Odyssey (ix. 391) in the sense of a blacksmith, or worker of iron.' What does this prove? It proves that Greek was spoken before the introduction of iron. The name for copper is shared in common by Latin and the Teutonic languages, *æs*, Latin; *aiz*, Gothic; *ér*, old high German; *erz*, modern German; *ár*, Anglo-Saxon; and the same word is represented in our English word *ore*. But the words specifically used for iron differ in each of the principal branches of the Aryan family. At the same time the words originally representing copper come to be used for metal in general, and in some cases for iron. In Sanskrit, *ayas*, which is the same word as *æs*, came to be used for iron, a distinction being made between dark *ayas* or iron, and bright *ayas* or copper. *Æs* in Latin, and *aiz* in Gothic, came to be used for metal in general, but was never used for iron. *Aiz*, however, according to Grimm, gave rise to the Gothic word *eisarn*, meaning iron. In old high German *eisarn* is changed into *ísarn*, later to *ísan*, and lastly to the modern *eisen*, while the Anglo-Saxon *ísern* is converted into *íren*, and ultimately to *iron*. The learned Professor sums up his researches on this subject as follows:—'We may conclude,' he says, 'that Sanskrit, Greek, Latin, and German were spoken before the discovery of iron, that each nation became acquainted with that most useful of all metals after the Aryan family was broken up, and that each of the Aryan languages coined its name for iron from its own resources, and marked it by its own national stamp, while it brought the names for gold, silver, and copper from the common treasury of their ancestral home'.[1]

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[1] Arma antiqua manus, ungues, dentesque fuerunt
Et lapides, et item sylvarum fragmina rami,
Et flamma atque ignis postquam sunt cognita primum
Posterius ferri vis est aerisque reperta,
Et prior aeris erat quam ferri cognitus usus,
Quo facilis magis est natura, et copia maior.—V. 1282.

[2] Strabo, b. iii. c. iii. 6, p. 154.

These remarks point to a very remote period, and to an Aryan origin for the first knowledge of copper and bronze, but on the other hand much has been written in favour of a Semitic origin, especially by Professor Nilsson, who believes that he has discovered traces of that people even on the coast of Norway.[2]

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[1] Max Müller, *Science of Language*, 2nd Series (1864), pp. 229–37.

[2] Nilsson, *The Primitive Inhabitants of Scandinavia* (Lubbock, 3rd ed., 1868), p. 257.

The employment of war chariots, which are known to have been used by the Britons, and vestiges of which have been found in their graves, implies, it is said, Semitic influence. Much stress is also laid upon the resemblance of some of the ornaments found on the Danish and other bronzes to those in use by the Phoenicians; more especially the spiral ornaments, which Professor Nilsson traces to that source through the engravings on weapons in the bronze age tumuli. Against this, however, it may be urged that the spiral ornament has a very wide distribution, extending over modern Africa, ancient Egypt, Greece, China, New Guinea, Mexico, and South America, and even to New Zealand and the Asiatic Isles. In illustration of this I have arranged upon Plate XIX a series of illustrations of spiral ornament from various countries, showing how universally it is distributed over the globe. Fig. 12 is from a New Zealand canoe in my collection; Fig. 13, from a club brought from New Guinea by the commander of the 'Rattlesnake', in 1849, and now in my collection; Fig. 14, from China; Fig. 15, from ancient Egypt; Fig. 16, from Greece; Fig. 17, from a Danish bronze sword; Fig. 18, from an Irish bronze brooch in my collection; Fig. 19, from the Swiss lakes, figured in Dr. Keller's work; Fig. 20, an iron ornament in my collection from Central Africa; Fig. 21, an iron ornament on a club, from the Bight of Benin, West Africa, in the Christy Collection; Fig. 22, an ornament on a wooden arrow-head, in the Christy Collection, probably from one of the Melanesian isles; Fig. 23, from Hallstatt; Fig. 24, a cane arrow-head from the Amazons, South America; Fig. 25, a spindle-whirl from Mexico; Fig. 26, on a bronze shield from the Caucasus: Fig. 27, an ornament on a bracelet from Hindustan, in the British Museum; Fig. 28, an ornament carved upon the stones of New Grange, in Ireland; Fig. 29, from a New Zealand canoe. Compare the two last figures with Fig. 30, a stone weight in my collection, lately fished up on the coast of Kent, whilst dredging for whelks; the ornamentation so closely resembles the New Zealand pattern, and at the same time that of the stone carvings of the European tumuli, that considering the circumstance of its discovery, it is purely a matter for conjecture whether it is to be referred to the antiquities of this country, or has been dropped overboard by some vessel returning from our South Pacific colonies. We see from these examples that the spiral ornament cannot be regarded as belonging exclusively to any one race; it is a contrivance derived simply from the coil of string, the source from which, and also from straw plaiting, nearly all barbaric ornamentation had its origin; it is a proof merely of barbaric origin, an evidence of continuity from the earliest periods of art.

Mr. Franks in his remarks at the Paris Meeting of the International Congress of Prehistoric Archaeology, has summarily disposed of the question of Phoenician ornamentation, by observing that the Phoenicians were copyists, taking their style from Egypt, Greece, or Rome, according to the fashion of the period, and that in point of fact a Phoenician style of art has never existed (*Compte Rendu, II^me^ Session,* Paris, 1868, p. 251).

Amongst those who have upheld the theory of the origin of bronze from Phoenician sources, may be mentioned Mr. Howorth, in a paper lately published in the *Transactions of the Ethnological Society* (1868, N.S., vol. vi. pp. 73–100); and Sir John Lubbock, though not committing himself to the same view as regards the origin of bronze, has nevertheless been at the pains of ably defending the ancient authors who speak of Phoenician intercourse with Britain from the attacks made upon them by Sir George Cornewall Lewis (*Prehistoric Times,* 1869, pp. 59–69).

This being the existing state of our knowledge in regard to the introduction of bronze, and the variety of opinion on the subject being, as we have seen, considerable, the task before us will be to ascertain as far as may be possible, from the implements themselves, the history of their origin, by examining carefully their construction in the various regions in which they occur, and by tracing the geographical distribution of those details of form which show evidence of connexion; thereby to determine, if possible, the sources from which they were derived. Whatever degree of veracity we may be disposed to attribute to early history, we must at least admit that the implements have this advantage over written testimony of any kind, that they cannot intentionally mislead us. If we draw wrong inferences from them, the fault is our own. We shall find the evidence very fragmentary as yet, but sufficient to prove that it affords a valuable source of information whenever sufficient materials are collected to enable us to work out the problem to its legitimate ends.

On the present occasion I propose to confine my remarks to showing, by means of the accompanying table (Plate XVIII), the distribution of some of the commoner varieties of the copper and bronze celt, an instrument which, like its prototype in stone, appears to have been employed both as tool and as weapon for all the various purposes to which it was capable of being turned, and to have been used not merely as a hatchet and battle-axe, but also to have been sometimes hafted on the end of a straight handle, to be used as a spud or crowbar, and even perhaps, as some of the forms appear to indicate, as a spade in tilling the ground.

The table is arranged upon the same plan as Plate XIII of my last lecture, and is intended to serve as a continuation of Plate XII of the same lecture, showing a further development of the same weapon. The successive developments are arranged, in order, by classes from left to right; the several localities are separated by horizontal dotted lines, by means of which are seen the various types prevalent in each locality, in so far as I have been able to obtain drawings from published sources; there can be no doubt, however, that the table is still very imperfect, and that considerable additions may be made to it hereafter. On the left, in Class A, will be found celts with convex surfaces, identical in form to those constructed of stone, the relative antiquity of which is shown by their being almost invariably of pure or nearly pure copper. It has been suggested that this form may have been adopted on account of its being more easily produced by beating the copper, and that its resemblance to the stone celts is not necessarily a proof of age; but there is no reason why Class B should not be as easily formed as Class A by this means, and many are so formed, as may be seen in the table. Moreover, Fig. 3 *a* is a *bronze* celt of the earlier form, taken from *Prehistoric Times*, and as this must have been cast in a mould, its peculiar shape can only be accounted for by supposing it to have been constructed in imitation of the stone celts. In passing from Class B, a gradual development of form may be traced, commencing with a slight stop or ridge across, and rudimentary flanges along the side of the shaft of the blade, developing in size and improving in form, no doubt, as the art of casting bronze became gradually perfected.[1] These stops and flanges are at first raised on the surface of the blade, but by degrees the same purpose is effected by sinking a groove in the blade to receive the handle, thereby economizing the metal, and producing a more symmetrical form; the flanges were at the same time bent over, and ultimately cast with a cavity on each side to receive the handle, and obviate the necessity for binding on the celt with thongs. This led by degrees to the ultimate perfection of the weapon, by the introduction of the socket type, which is associated with weapons of iron, and is sometimes itself constructed of that metal.

The order of development here adopted is in the main that followed by Sir William Wilde, in his *Catalogue of the Museum of the Royal Irish Academy*, but I have omitted all mention of branch varieties, as they do not serve my purpose of illustrating the continuity of development, though they are valuable in showing the connexion between localities.

Although the course of development appears to have followed the order here indicated, it is not unlikely the earlier forms may have continued in use, and may even have continued to be constructed at the same time as the later forms. The earlier and less complicated types, being easier of construction, and being equally serviceable for some purposes, would continue to be made, in the same way that smooth-bores and rifle-barrels, row-boats, sailing-vessels, and steam-packets, continue to be used simultaneously in our own time.

The progress of development of this weapon will be better understood by a detailed reference to the figures.

Reference to the Figures in Plate XVIII.[2]

COPPER, BRONZE, AND IRON CELTS.

CLASS A.—Copper celts from various localities, having convex surfaces, in form resembling those of stone.—Figs. 1, 2, and 3, from Ireland, *in my collection.*—Fig. 3 *a*, a bronze celt of the same form, from Le Puy, France, *Prehistoric Times*, p. 27.—Fig. 4, copper celt found at Blengow, Mecklenberg-Schwerin Museum; *Horae Ferales.*—Fig. 5, copper celt from the lake dwellings of Sipplingen, Switzerland, found embedded in a coating of clay (a mould?). See Keller, *The Lake Dwellings of Switzerland*, (transl. J. E. Lee, 1866), p. 121, Plate xxix.—Fig. 6, copper celt found in an Etruscan tomb, and now in the Berlin Museum. See *Catalogue of the Royal Irish Academy*, 'Bronze,' pp. 367, 395.

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[1] Sir Richard Colt Hoare found four of these celts in the Wiltshire barrows, with rudimentary flanges along the side edges of the blade that had been formed by beating, and similarly formed flanges have also been noticed upon celts from Ireland, thereby leading to the supposition that Class B may have been converted into Class D in this way, before the casting process was applied to the formation of the flanges.—*The Ancient History of South Wiltshire* (London, 1812), p. 203, pl. xxi, xxvi, xxviii. 2, xxix.

[2] (The greatly reduced scale of these figures makes exact verification of the references impracticable in all cases.—ED.)

Class B.—Copper and bronze celts from various localities, having flat concave sides, and a rectangular cross section, showing a gradual enlargement of the cutting edge.—Figs. 7 to 12, copper celts from Ireland, *in my collection*, showing a gradual enlargement of the cutting edge.—Figs. 13, 14, 15, ditto, *ditto*, of bronze, the sides more concave, and the cutting edge more expanded.—Fig. 16, bronze celt, of similar form, from Denmark (Madsen, *Afbildninger af Danske Oldsager og Mindesmærker*, Copenhagen, 1872, Heft iii, Fig. 1).—Fig. 17, copper celt from Steinfurt, in the collection of Professor Dieffenbach, at Friedberg, Lindenschmit, *Die Alterthümer unserer heidnischen Vorzeit* (Mainz, 1864 ff.), Plate 3.—Fig. 18, ditto of copper, found near Mainz, Museum of Mainz, *Lindenschmit*, Plate 3.—Fig. 19, the same form of bronze, from near Mainz, *Lindenschmit.*—Fig. 20, the same form of bronze from Italy, *British Museum.*[1]—Figs. 21, 22, 23, the same form of copper from Hungary, *Keller*, p. 219, Plate lxviii.—Figs. 24, 25, 26, similar forms of bronze, with rectangular holes, from the Island of Thermia, Greek Archipelago, *British Museum.*

Class C.—Bronze celts of the same outline as Class B, but having a cross ridge or stop on both faces, to prevent the blade from burying itself in the handle.—Figs. 27, 28, bronze celts from Ireland, *in my collection*; this form is common to the British Isles.

Class D.[2]—Bronze celts, having four longitudinal ridges or flanges, one on each edge, but no cross stop. The flanges are for the purpose of fixing the blade in a bent handle; they exhibit a gradual development of the flange, and an expansion of the cutting edge, which latter takes a semicircular, and in some cases nearly a circular form.—Figs. 29, 30, from Ireland, *in my collection*, showing front view and section.—Fig. 31, from Versailles, *in my collection*, with section.—Fig. 32, from France; with side view; see *Matériaux pour l'Histoire de l'Homme*.—Fig. 33, from Loyette, Department of Isère, from *Horae Ferales*, front view.—Fig. 34, from the South of France, *British Museum*, the blade very circular.—Fig. 35, from Alps [Aps?], in Ardèche, *British Museum*, the circular form of the blade still more developed. This form appears peculiar to the neighbourhood of the Rhone, *Horae Ferales*.—Fig. 36, from France; with side view; *Matériaux*. —Fig. 37, from Denmark, *British Museum*, of copper; this form is rarely found in copper; with section.—Fig. 38, from Denmark, of bronze, from *Madsen*, Heft iii.—Fig. 39, from Denmark, with semicircular blade, *Madsen*, Heft iii.—Fig. 40, from Hessen, now in the collection at Hanover, *Lindenschmit*, Heft i, Taf. iii.—Fig. 41, from near Baltringen, *Lindenschmit*.—Fig. 42, from Neinheiligen, in Thuringia, *British Museum*; with section.—Fig. 43, from the Terramara Beds, Castione, Switzerland; with section; *Keller*, Plate lix. — Fig. 44, from Unter Uhldingen; with section; *Keller*, Plate xxix. —Fig. 45, from the Terramara Beds, Castione; with section; *Keller*, Plate lix.—Fig. 46, from the Terramara Beds, Castione; with section; *Keller*, Plate lix.—Fig. 47, from Hallstatt, in Austria, von Sacken, *Das Grabfeld von Hallstatt in Oberösterreich und dessen Alterthümer* (Vienna, 1868), Taf. vii; with side view.—Fig. 48, ditto, *ditto*, found with the body of a child.—Fig. 49, ditto, the shaft of bronze, and the blade of iron, from Hallstatt. —Fig. 50, the same form in iron, also from Hallstatt, *in Mr. John Evans' collection*.—Figs. 51 and 52, similar forms, in bronze, from Italy, *British Museum*.—Fig. 53, the same form, from Telsch, Vilna, Russia, *British Museum*; with two sections.

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[1] I have been enabled to take drawings of these celts in the British Museum, through the kind permission of Mr. A. W. Franks.

[2] The forms included in Classes D, E, F, and G, are commonly known under the name of *paalstab* or *palstave*, a word of Scandinavian origin, said to have designated the weapons employed by some northern tribes for battering the shields of their enemies. Iron implements like the Irish *loy*, and called *paalstabs*, are still used in Iceland, either for digging in the ground or breaking the ice.—*Catalogue of the Museum of the R. I. Academy*, 'Bronze,' p. 361.

Class E.—Bronze celts having both the cross stop and the longitudinal flanges. In the earliest form, the cross stop and flanges are raised upon the faces of the blade, as in Class D. In the more improved form, the upper part of the shaft of the blade is hollowed so as to answer the same purpose and economize the metal. Figs. 54–8, from Ireland; Fig. 54, with rudimentary stop and flanges, *in my collection*. Figs. 55 and 56, ditto, with rudimentary stop, the flanges more developed; *in my collection*. Fig. 57, showing a development of both stop and flange, ditto, *ditto*. Fig. 58, showing the stop and flange further developed, and the metal of the upper part of the blade slightly sunk, ditto, *ditto*. Fig. 59, a further development of the same, the metal of the upper part of the shaft of the blade reduced to a minimum.—Fig. 60, the same form as Fig. 54, from Denmark, *Madsen*, Heft iii.—Fig. 61, from near Mainz, *Lindenschmit*, Taf. iii.—Fig. 62, from the Museum at Wiesbaden, *Lindenschmit*, Taf. iii.—Fig. 63, from Altona, in Courland; this form has some affinity to Class G, but is introduced here on account of the expansion of the blade.—Figs. 64, 65, and 66, from Italy, *in the British Museum*, the metal of the shaft slightly sunk to produce a stop.—Fig. 67, from Fiesole, Italy, the metal part of the shaft further reduced.—Fig. 68, from Baron von Stackelberg's collection, *in the British Museum*, also described in Klemm, *Werkzeuge und Waffen*, p. 103, Fig. 180; said to be from Greece, but its close resemblance to those from Italy is remarkable.

Class F.—The same form as Class E, but having the flanges bent by hammering over the stop; the flanges appear to have been cast upright, as in Class E, and to have been bent over the cleft handle after hafting; by this means the necessity for binding the blade on with thongs was obviated. This class forms a transition to the socket type.—Figs. 69, 70, 71, from Ireland, *in my collection*.—Fig. 72, from the Royal Irish Academy collection, having a loop on the side. See *Catalogue R. I. A.*, 'Bronze,' page 379. The introduction of the loop appears to be synchronous with the abandonment of the binding, the overlapping flanges answering that purpose by enclosing the bent portion of the handle, and requiring only that it should be fastened by the loop to prevent its falling off the end of the handle.—Fig. 73, from Denmark, *in my collection*.—Figs. 74, 75, from Denmark, *Madsen*, Heft iii.—Fig. 76, from the Museum at Hanover, *Lindenschmit*.—Fig. 77, from the Museum at Munich, *Lindenschmit*, Taf. iv.—Fig. 78, from Möringen, Switzerland, *Keller*, Plate xli.—Fig. 79, from Nidau-Steinberg, Switzerland, *Keller*, Plate xxxv.—Fig. 80, from Hallstatt, *Von Sacken*.—Fig. 81, from Italy, *British Museum*.

CLASS G.—The pocket type. The bent portion of the handle in this case was retained in its place by pockets cast on each side of the shaft of the blade; it seems doubtful whether this, or Class F, is to be regarded as the nearest approach to the socket type. In Class F the overlapping was produced by hammering the metal; but Class G is a further advance in the casting process.—Figs. 82 and 83, from Ireland, *in my collection*; the latter with loop; the pockets or pouches to receive the points of the bent handle are shown in the sections.—Fig. 84, from France; see *Matériaux pour l'Histoire de l'Homme*.—Fig. 85, found twelve leagues south of Oviedo, Spain, *in the collection of the Society of Antiquaries*.—Fig. 86, from Andalusia, Spain, *British Museum*.—Fig. 87, from Denmark, *Madsen*, Heft iii.—Fig. 88, from the collection at Munich, *Lindenschmit*.—Fig. 89, from the collection at Hanover, *Lindenschmit*.—Fig. 89*a*, an iron celt of the same form, still in use by the Kalmucs, Siberia, *Prehistoric Times*, p. 26.

CLASS H.—The socket type. In some of the specimens of Class G, as for example Figs. 82 and 83, the metal portion of the shaft of the blade dividing the two pouches is reduced to a minimum. The next step was to do away with it altogether and enlarge the sides of the pouches so as to form a single socket. By this means the bent handle no longer required to be cleft to receive the blade, but was inserted whole into the socket, producing greater firmness, each blow of the axe serving to fix it more securely to its handle. The loops, seen only occasionally on Classes F and G, are almost invariably present in Class H.—Figs. 90, 91, 92, 93, 94. Socket celts of bronze, from Ireland and England, *in my collection*; the form with square sides is very uncommon in Ireland; in Fig. 92 a representation of the overlapping flange of Class F is cast on the surface of the socket.—Fig. 94*a*, a socket celt of wrought iron with loop, from Merionethshire, *British Museum*; *Archaeologia Cambrensis*, vol. i, third series, p. 250.—Figs. 95 and 96, the same forms from France. See *Matériaux, &c.* The square-sided celt is common in the north of France.—Fig. 97, from Alemquez, Portugal; *Coll.*

Société des Archit. Portugais.—Fig. 98, from Denmark, *in my collection.*—Figs. 99, 100, Denmark, *Madsen,* Heft i.—Fig. 100*a*, an iron socket celt, from the moss of Nydam, in Slesvik, of the iron period; Engelhardt, *Denmark in the Early Iron Age* (1866), Pl. xv; believed, from the Roman coins found with it, to be of the third century A.D.[1]—Fig. 101, from the collection at Hanover, *Lindenschmit.*—Fig. 102, from the Museum at Mainz, *Lindenschmit.*—Fig. 103, socket celt of iron, from Golssen, *Klemm,* Fig. 195.—Fig. 104, socket celt of iron, from Thuringia, *Klemm,* Fig. 194.—Fig. 105, of bronze, from Unter Uhldingen, Switzerland; *Keller,* Pl. xxix.—Fig. 106, of iron, found near Marin, Switzerland, the socket formed by beating over the blade on one side only; the socket is not quite completed; see *Keller,* Pl. lxxi.—Fig. 107, the same form of iron, found near Marin; the socket is closed and completed all round, *Keller,* Pl. lxxi. These specimens in iron may be regarded as connecting links between Classes F and H. Viewing the occurrence of iron celts of this form, it appears not impossible that the introduction of the socket type and the sudden abolition of the central division may have been suggested by the use of the more malleable metal, by means of which the fabricator acquired the art of forming a socket by bending over the metal on one side; the inutility of the central division would thus become apparent.—Fig. 108, bronze socket celt with loop, from Hallstatt, *Von Sacken.*—Fig. 109, exactly the same form in iron, from Hallstatt; a portion of the wooden handle is still shown in this specimen.—Figs. 110 and 111, bronze socket celts, from Italy, of a variety peculiar to that country, *British Museum.*—Fig. 112, socket celt of copper, from Hungary, believed by the author to be the only known specimen of pure copper; *Keller,* Pl. lxxviii.—Fig. 113, bronze socket celt, from Hungary, *British Museum.*—Fig. 114, bronze socket celt, with two loops, from Kertch, *British Museum.*—Fig. 115, bronze socket celt, from the province of Viatka, Russia. See *Matériaux, &c.*—Fig. 116, bronze socket celt with two loops, from the Ural, Russia.—Fig. 117, mode of hafting, Classes A, B, and C.—Fig. 118, mode of hafting, Classes D, E, F, and G.—Fig. 119, mode of hafting, Class H.

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[1] Lubbock, *Prehistoric Times* (1869), p. 9.

In a paper lately read to the Society of Antiquaries by Dr. Thurnam,[1] he has drawn attention to the fact that none but celts of the most primitive type, viz. those belonging to Classes B, C, D, and the most rudimentary form of Class E, have been found in the British tumuli. Scarcely a single instance of the more developed palstave or of the socketed celt has as yet been discovered; the only exceptions being a bronze socket celt found in a tumulus on Plumpton Plain, near Lewes, and a diminutive bronze socket celt found in a tumulus at Arras in the Yorkshire wolds. These Arras barrows are known, however, to belong to the iron age; having produced, amongst other articles composed of that metal, the iron tire of the wheel, and trappings of a war chariot. We learn from this that the discoveries in the tumuli confirm in point of time the order of development inferred from a consideration of the implements themselves.

From the foregoing detailed description of Plate XVIII we are enabled to draw the following conclusions, viz.:—(1) That in each of the divisions of Europe therein represented, traces of the development of the celt, from its simplest to its most complex form, have been discovered; the earliest forms being in imitation of those of stone, and being not unfrequently constructed of pure copper. Where some of the connecting links are wanting in the table there is reason to suppose the absence of those links may be the result of imperfect information, and does not necessarily imply a flaw in the continuity of development. (2) That, notwithstanding the simultaneous development which appears to have taken place in different countries, we may nevertheless observe slight differences in the details of construction, which are sufficient to give a distinctive character to the celts of each separate region. Thus, for instance, the celts from Ireland are, as a general rule, shorter and less elegant in form than those found on the Continent. Class C, consisting of stop celts without wings, though common in Great Britain and Ireland, is, so far as I have been able to ascertain, unknown on the Continent. On the other hand, Class D, having wings without stops, is rare in Ireland, but common in France,

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[1] Read in 1869, published in *Archaeologia*, xliii. p. 443 : for Plumpton Plain, see *Sussex Arch. Coll.* ii. p. 268 : for Arras, *Arch. Journ.* xviii. p. 156.

Denmark, Germany, and Switzerland. The development of this class of celt into a nearly circular edge, as represented in Figs. 34 and 35, is peculiar to the south of France, though traces of it are observable in the celts from Germany, Fig. 40. Class E, having both stop and flange, is found in a more rudimentary stage in Ireland than elsewhere. The palstaves of this form, having shoulders on the side of the blade, are peculiar to Italy and Switzerland, Figs. 66, 67, and 68. Class F, with overlapping wings, is but slightly developed in Ireland, but is fully so in Italy, Germany, and at Hallstatt. Class G, the double pocket variety, has its head quarters in the north-west of France, but is also known in Ireland, Denmark, Spain, and Germany; it is, in so far as I have been able to ascertain, unknown in Italy. Class H, the socket type, varies greatly in different countries; the square form, Figs. 93, 94, 95, 96, 100, and 102, is exceedingly rare in Ireland, but common in France. The socket celts from Italy, Figs. 110 and 111, are of peculiar type, and evidently derive their form from the winged palstave of the same country, Fig. 67. Socket celts of iron have been found at Hallstatt, and in Switzerland, Denmark, Germany, and North Wales. The representation of the overlapping wings, cast on the surface of the socket celt, Figs. 92 and 101, is common in England and Germany, but exceedingly rare in Ireland. The double-looped socket celt, Figs. 97, 114, and 116, appears to be especially characteristic of the Eastern provinces of Russia and Siberia, though found occasionally elsewhere.

In attempting to account for the varieties, which I have described, in the details of construction, coupled with a general uniformity of design throughout the entire region of distribution of these weapons, we may, I think, draw an exact parallel between the development of bronze celts and the development of the forms of cannon between the fourteenth and the nineteenth centuries. From Europe to China we know that the form of cannon has developed upon the same plan. In the same way that the overlapping wings of the palstave were represented on the faces of the socket celt, so the rings of metal which bound together the bars of which the ancient bombard was composed, were represented on the surface of the cast bronze cannon which superseded it. In every country the general type of development of cannon has been the same, but the details of construction have varied in each. Even in our own time, the introduction of breech-loaders has been synchronous throughout Europe; but the French and English cannon are not perfectly identical. Now, the cause of this is sufficiently well known. There has been constant intercommunication between the several countries throughout the whole period of the development of this weapon. Each new improvement as it occurred has been communicated from one country to another, either by contact in war, or by peaceful intercourse; but each country has fabricated its own weapons, and has by that means contrived to give them a national character.

So in like manner we must assume that the development of the bronze celt extended over a long period of time; that each new improvement was communicated from tribe to tribe and from nation to nation; but that each country manufactured its own implements, and varied in the construction of them. The proof that this was the case is found in the circumstance that moulds for casting them have been found in different countries. Plate XX, Fig. 31, represents a stone mould found at Ballynahinch, Co. Down, Ireland, and figured in the *Catalogue of the Royal Irish Academy*; it is adapted for casting celts of the Class B. Fig. 32 is a stone mould for Class G, found at Montaigu, near Valoignes, Normandy, and is taken from a cast in the Museum of the Society of Antiquaries. Fig. 33, a stone mould for Class H, from Kilkenny, Ireland. Fig. 34, two halves of a bronze mould for Class E, from Morges, Switzerland, figured in Keller, Plate xxxix. Fig. 35, two halves of a bronze mould for Class H, found in the Forest of Bricquebec, Normandy, in the Museum of the Society of Antiquaries. Fig. 36, one-half of a bronze mould for Class H, from England, figured in the *Catalogue of the Royal Irish Academy*, 'Bronze,' page 393. In the three last specimens it will be seen that the mode of fitting the two halves together, so as to prevent the escape of the metal, is by means of a ridge on one half, fitting into a groove in the other. It is improbable that a contrivance so identical as this should have arisen independently in the three countries. Further proof of connexion is shown by the identity of the ribs in the interior of the sockets of celts belonging to Class H.

Figs. 37 and 38 represent sections of socket celts from Ireland, the former showing three, the latter one, longitudinal rib of raised metal running from the bottom of the socket for some distance up the side of the interior of the socket. Fig. 39 is the section of a socket celt from Denmark, in my collection, having one rib of the same kind. It has been suggested that these ribs represent the interstices between slices of the core, by means of which the socket was formed in casting; if so the cores must have been constructed of some hard material, cut in slices, in order to facilitate their removal from the socket when formed. Several objections may, however, be urged against this; in the first place, no such cores have ever been discovered, which tends to the supposition that the cores must, in all probability, have been constructed of clay; in the second place, it will be seen by reference to Fig. 20 that this celt has only one central rib; if, therefore, the rib was formed by the metal pressing into the interstices between the slices of the core, it is evident that the core in this case had only two slices; but it will be seen that the aperture of the socket expands towards the bottom, and it would have been impossible, therefore, to extract the core if it were divided into only two parts.

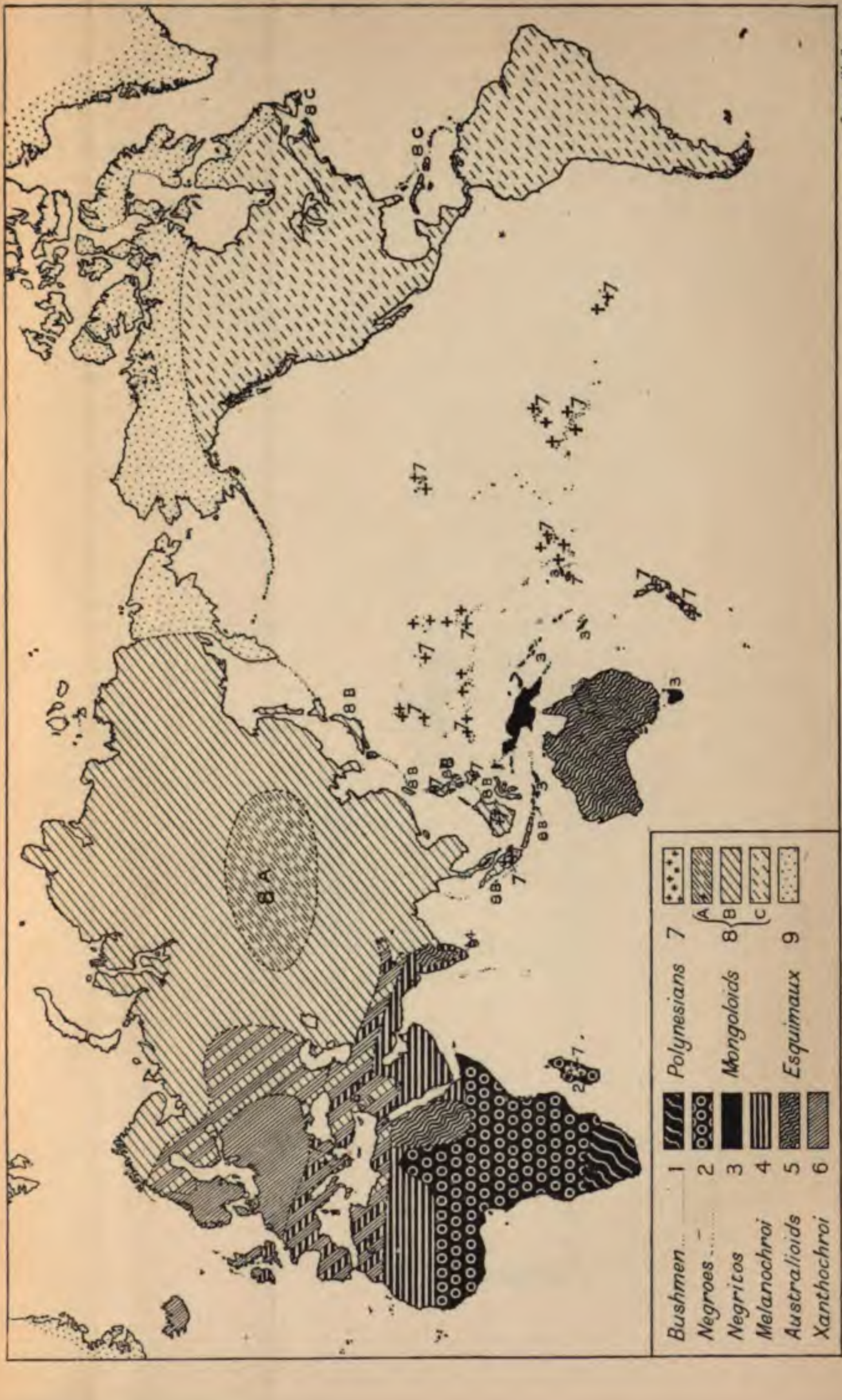
The theory of core slices must, therefore, be abandoned, and we are driven to the conclusion that the ribs must have been intentional, either to give strength to the celt, which is unlikely from the great thickness of the metal, or to form channels for the passage of the metal in casting, or, what is more probable, to serve the purpose of gripping the portion of the wooden handle which fitted into the socket, and preventing its shifting with the blows of the weapon. Fig. 39 represents cross ribs at the bottom of the socket of a celt from Denmark, in my collection. Whatever may have been the purpose for which the ribs were formed, their identity in the implements of the two countries serves us as an additional proof of intercourse between them.

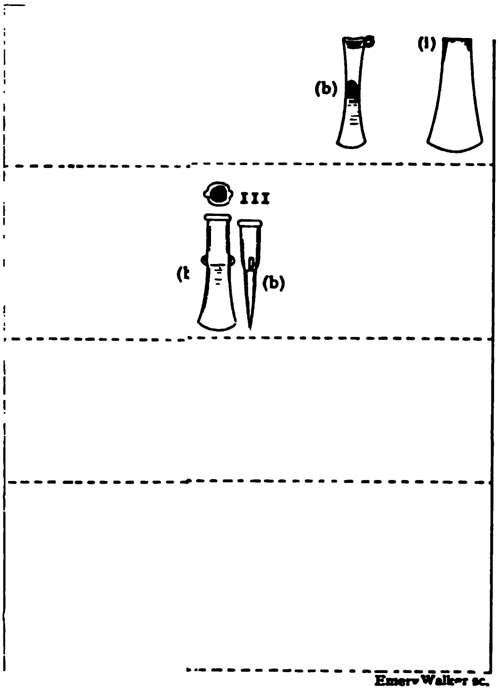
Although moulds for casting celts have not been found in Denmark, there is evidence to show, from vestiges of scoriae that have been found, that they were there cast in clay, as indeed they must probably have been to a great extent in other parts of Europe.

It would be premature to speculate upon the primary sources

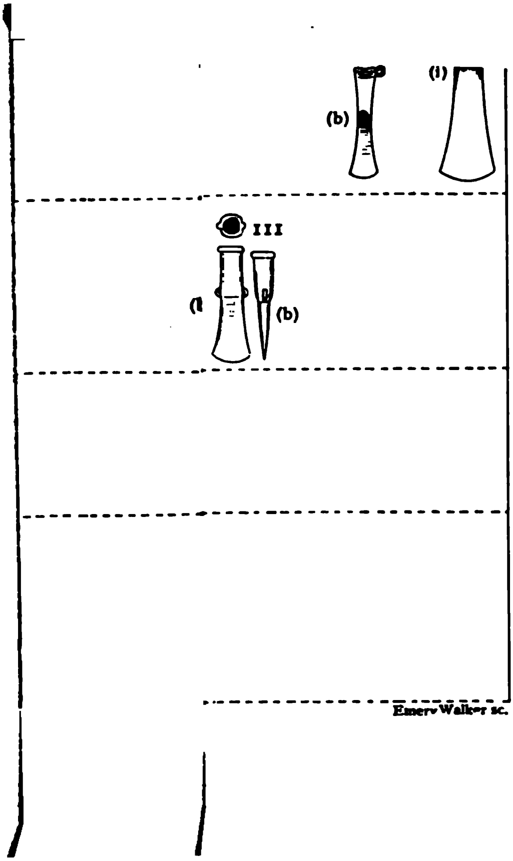
[*J. R. U. S. I.*, XIII. Pl. xxxi, *in colour.*]

PLATE XVII.





Emery Walker sc.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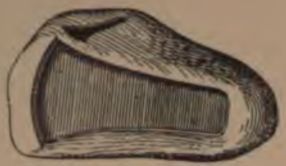
[*J. R. U. S. I.*, XIII. Pl. xxxiii, *lower half.*]

PLATE XX.

CELT MOULDS

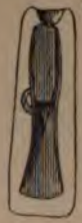
Scale 1/4

31



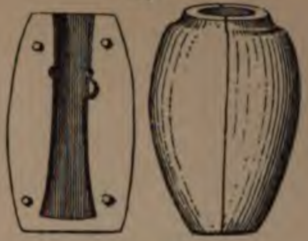
IRELAND

32.



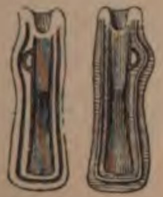
NORMANDY

33



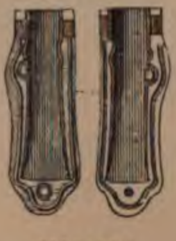
IRELAND

34



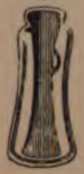
SWITZERLAND

35



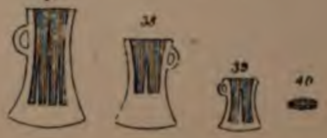
NORMANDY

36



ENGLAND

SECTIONS OF SOCKET CELTS



IRELAND

DENMARK

of the bronze civilization of Europe, until we have examined carefully the distribution of the other weapons belonging to that period. This much may, however, I think, be said with respect to the geographical region of bronze celts, that they belong more especially to the north and west of Europe; they have never been found in any of those countries which were occupied by the Phoenicians, nor have we any sufficient reason for believing that they were common in Greece. We have, therefore, no evidence whatever for supposing that the north of Europe derived the first idea of these weapons from either of those nations. We certainly have only negative evidence as yet for affirming that they did not, but the burden of proof must rest with those who have attributed them to the Phoenicians. To what extent they were employed in Russia and Northern Siberia, is a point which we have not as yet sufficient evidence to determine. I think, however, I am justified in saying that those hitherto discovered in Siberia are of a late type, belonging chiefly to the socket variety, and that they are there often associated with weapons of iron. I trust, however, to have an opportunity of entering more fully into this subject on a future occasion, when treating of the weapons of the later bronze and early iron periods of Europe.

EARLY MODES OF NAVIGATION[1]

(1874)

In the paper which I had the honour of reading to this Institute at Bethnal Green (pp. 1–19), I spoke of the general principles by which I was guided in the course of inquiries, of which the present paper forms a section. I need not, therefore, now refer to them further than to say that the materials for this paper were collected whilst writing a note to my *catalogue raisonné* relating to the case of models of early forms of ships.[2]

In inquiries of this nature it is always necessary to guard against the tendency to form theories in the first instance, and go in search of evidence to support them afterwards. On the other hand, in dealing with so vast a subject as Anthropology, including all art, all culture, and all races of mankind, it is next to impossible to adhere strictly to the opposite of this, and collect the data first, to the exclusion of all idea of the purpose they are to be put to in the sequel, because all is fish that comes into the anthropological basket, and no such basket could possibly be big enough to contain a millionth part of the materials necessary for conducting an inquiry on this principle. Some guide is absolutely necessary to the student in selecting his facts. The course which I have pursued, in regard to the material arts, is to endeavour to establish the sequence of ideas. When the links of connexion are found close together, then the sequence may be considered to be established. When they occur only at a distance, then they are brought together with such qualifications as the nature of the case demands. Other members of this Institute have followed the same course in relation to other branches of culture, the object being to lay the foundation of a true anthropological classification, without seeking either to support a dogma or establish a paradox. This is, I believe, the requirement of our time, and the necessary preliminary to the introduction of a science of Anthropology.

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[1] A Paper read at the Anthropological Institute of Great Britain and Ireland on December 22, 1874, and published in the *Journal* of the Institute, vol. iv (1875), pp. 399–435. (N.B.—This paper was not furnished by the author with either plates or references. The former have been supplied, so far as possible, on pp. 229 ff.: for illustrations, reference should be made to the section on Navigation in the Pitt-Rivers Museum, Oxford.—Ed.)

[2] (The *Catalogue of the Anthropological Collection lent by Col. Lane Fox to Bethnal Green Museum* (London, 1874, parts i and ii) only contains 'Weapons'; part iii was never issued.—Ed.)

Whilst, however, deprecating the influence of forgone conclusions, there are certain principles already established by science which we cannot afford to disregard, even at the outset of inquiries of this nature. It would be sheer moonshine, in the present state of knowledge, to study Anthropology on any other basis than the basis of development; nor must we, in studying development, fail to distinguish between racial development and the development of culture. The affinity of certain races for particular phases of culture, owing to the hereditary transmission of faculties, constitutes an important element of inquiry to be weighed in the balance with other things, just as the farmer weighs in the balance of probabilities the nature of the soil in which his turnips are growing; but when particular branches of culture do run in the same channel with the distribution of particular races, this is always a coincidence to be investigated and explained, each by the light of its own history. It would be just as reasonable to assume with the ancients, that the knowledge of every art was originally inculcated by the gods, as to assume that particular arts and particular ideas arise spontaneously and as a necessary consequence of the possession of particular pigments beneath the skin.

Nobody doubts that there must be affinities and interdependencies between the race and the crop of ideas that is grown upon it; but the law, *ex nihilo nihil fit*, is as true of ideas as it is of races, and in the relations between them it is as true and has the same value, neither more nor less, as the statement that potatoes do spring out of the ground where no potatoes have been sown. To study culture is, therefore, to trace the history of its development, as well as the qualities of the people amongst whom it flourishes. In doing this it is not sufficient to deal with generalities, as, for example, to ascertain that one people employ bark canoes, whilst another use rafts. It is necessary to consider the details of construction, because it is by means of these details that we are sometimes able to determine whether the idea has been of home growth or derived from without. The difficulty is to obtain the necessary details for the purpose. Travellers do not give them, as a rule, especially modern travellers. The older books are more valuable, both because they deal with nations in a more primitive condition, and also because they are more detailed; books were fewer, and men took more pains with them; now the traveller writes for a circulating library, and for the unthinking portion of mankind, who will not be bothered with details. I have been careful to give the dates to the authors quoted. But we must endeavour to remedy this evil before it is too late. The *Notes and Queries on Anthropology*[1], published by the Committee of the British Association, are drawn up with this object. It is to be hoped that they will receive attention, but I fear not much, for the reasons already mentioned; the supply will be equal to the demand. As long as we have a large Geographical Society and a small Anthropological Society, so long travellers will bring home accurate geographical details, abundance of information about the flow of water all over the world, but the flow of human races and human ideas will receive little attention. With these preliminary remarks I pass on to the subject of my paper.

Modes of Navigation.

Following out the principle adopted in Parts 1 and 2 of my Catalogue, of employing the constructive arts of existing savages as survivals to represent successive stages in the development of the same arts in prehistoric times, it may be advisable, in order to study the history of each part of a canoe or primitive sailing vessel, to divide the subject under seven heads, as follows: viz.—(1) Solid trunks or dug-out canoes, developing into (2) Vessels on which the planks are laced or sewn together, and these developing into such as are pinned with plugs of wood, and ultimately nailed with iron or copper; (3) Bark canoes; (4) Vessels of skins and wicker-work; (5) Rafts, developing into (6) Outrigger canoes, and ultimately into vessels of broader beam, to which may be added (7) rudders, sails, and contrivances which gave rise to parts of a more advanced description of vessel, such as the *oculus*, *aplustre*, *forecastle*, and *poop*.

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[1] *Notes and Queries on Anthropology, for the Use of Travellers and Residents in Uncivilized Lands*, drawn up by a Committee appointed by the British Association for the Advancement of Science (1874); 3rd edition, 1899, published by the Anthropological Institute, 3 Hanover Square, W.

1. *Solid Trunks and Dug-out Canoes.*

It requires but little imagination to conceive an idea of the process by which a wooden support in the water forced itself upon the notice of mankind. The great floods to which the valleys of many large rivers are subject, more especially those which have their sources in tropical regions, sometimes devastate the whole country within miles of their banks, and by their suddenness frequently overtake and carry down numbers of both men and animals, together with large quantities of timber which had grown upon the sides of the valleys. The remembrances of such deluges are preserved in the traditions of many savage races, and there can be little doubt that it was by this means that the human race first learnt to make use of floating timber as a support for the body. The wide distribution of the word signifying ship—Latin *navis*; Greek *ναῦς*; Sanskrit *nau*; Celtic *nao*; Assam *nao*; Port Jackson, Australia, *nao*—attests the antiquity of the term. In Bible history the same term has been employed to personify the tradition of the first shipbuilder, *Noah*.

It is even said, though with what truth I am not aware, that the American grey squirrel (*Sciurus migratorius*), which migrates in large numbers, crossing large rivers, has been known to embark on a piece of floating timber, and paddle itself across (Wilson, *Prehistoric Man*, 1862, vol. i. p. 147).

The North American Indians frequently cross rivers by clasping the left arm and leg round the trunk of a tree, and swimming with the right (Steinitz, *History of the Ship*, Pl. 2).

The next stage in the development of the canoe would consist in pointing the ends, so as to afford less resistance to the water. In this stage we find it represented on the NW. coast of Australia. Gregory, in the year 1861, says that his ship was visited on this coast by two natives, who had paddled off on logs of wood shaped like canoes, not hollowed, but very buoyant, about 7 feet long, and 1 foot thick, which they propelled with their hands only, their legs resting on a little rail made of small sticks driven in on each side. Mr. T. Baines, also, in a letter quoted by the Rev. J. G. Wood, in his *Natural History of Man* (vol. ii. p. 7), speaks of some canoes which he saw in North Australia as being 'mere logs of wood, capable of carrying a couple of men'. Others used on the north coast are dug out, but as these are provided with an outrigger, they have probably been derived from New Guinea. The canoes used by the Australians on the rivers consist either of a bundle of rushes bound together and pointed at the ends, or else they are formed of bark in a very simple manner; but on the south-east coast, near Cape Howe, Captain Cook, in his first voyage, found numbers of canoes in use by the natives on the seashore. These he described as being very like the smaller sort used in New Zealand, which were hollowed out by means of fire. One of these was of a size to be carried on the shoulders of four men.

It has been thought that the use of hollowed canoes may have arisen from observing the effect of a split reed or bamboo upon the water. The nautilus is also said to have given the first idea of a ship to man; and Pliny, Diodorus, and Strabo have stated that large tortoise-shells were used by primitive races of mankind (Kitto, *Pictorial Bible*). It has also been supposed that the natural decay of trees may have first suggested the employment of hollow trees for canoes, but such trees are not easily removed entire. It is difficult to conceive how so great an advance in the art of shipbuilding was first introduced, but there can be no doubt that the agent first employed for this purpose was fire.

I have noticed when travelling in Bulgaria that the gipsies and others who roam over that country usually select the foot of a dry tree to light their cooking fire; the dry wood of the tree, combined with the sticks collected at the foot of it, makes a good blaze, and the tree throws forward the heat like a fireplace. Successive parties camping on the same ground, attracted thither by the vicinity of water, use the same fireplaces, and the result is that the trees by degrees become hollowed out for some distance from the foot, the hollow part formed by the fire serving the purpose of a semi-cylindrical chimney. Such a tree, torn up by the roots, or cut off below the part excavated by the fire, would form a very serviceable canoe, the parts not excavated by the fire being sound and hard. The Andaman islanders use a tree in this manner as an oven, the fire being kept constantly burning in the hollow formed by the flames.

One of the best accounts of the process of digging out a canoe by means of fire is that described by Kalm, on the Delaware river, in 1747. He says that, when the Indians intend to fell a tree, for want of proper instruments they employ fire; they set fire to a quantity of wood at the roots of the tree, and in order that the fire might not reach further up than they would have it, they fasten some rags to a pole, dip them in water, and keep continually washing the tree a little above the fire until the lower part is burnt nearly through; it is then pulled down. When they intend to hollow a tree for a canoe, they lay dry branches along the stem of the tree as far as it must be hollowed out, set them on fire, and replace them by others. While these parts are burning, they keep pouring water on those parts that are not to be burnt at the sides and ends. When the interior is sufficiently burnt out, they take their stone hatchets and shells and scoop out the burnt wood. These canoes are usually 30 or 40 feet long. In the account of one of the expeditions sent out by Raleigh in 1584 a similar description is given of the process adopted by the Indians of Virginia, except that, instead of sticks, resin is laid on to the parts to be excavated and set fire to: canoes capable of holding twenty persons were formed in this manner.

The Waraus of Guiana employ fire for excavating their canoes; and when Columbus discovered the Island of Guanahani or San Salvador, in the West Indies, he found [fire] employed for this purpose by the natives, who called their boats '*canoe*', a term which has ever since been employed by Europeans to express this most primitive class of vessel.

Dr. Mouat says that, in Blair's time, the Andaman islanders excavated their canoes by the agency of fire; but it is not employed for that purpose now, the whole operation being performed by hand. Symes, in 1800, speaks of the Burmese war-boats, which were excavated partly by fire and partly by cutting. Nos. 1276 and 1277 of my collection are models of these boats. In New Caledonia, Turner, in 1845, says that the natives felled their trees by means of a slow fire at the foot, taking three or four days to do it. In excavating a canoe, he says, they kindle a fire over the part to be burnt out, and keep dropping water over the sides and ends, so as to confine the fire to the required spot, the burnt wood being afterwards scraped out with stone tools. The New Zealanders, and probably the Australians also, employ fire for this purpose [Cook]. The canoes of the Krumen in West Africa are also excavated by means of fire.

A further improvement in the development of the dug-out canoe consists in bending the sides into the required form after it has been dug out. This process of fire-bending has already been described on p. 87 of my *Catalogue* (Parts i and ii), when speaking of the methods employed by the Esquimaux and Australians in straightening their wooden spears and arrow-shafts. The application of this process to canoe-building by the Ahts of the north-west coast of North America is thus described by Mr. Wood in his *Natural History of Man*, vol. ii. p. 732. The canoe is carved out of a solid trunk of cedar (*Thuja gigantea*). It is hollowed out, not by fire, but by hand, and by means of an adze formed of a large mussel-shell; the trunk is split lengthwise by wedges. All is done by the eye. When it is roughly hollowed it is filled with water, and red-hot stones put in until it boils. This is continued until the wood is quite soft, and then a number of cross-pieces are driven into the interior, so as to force the canoe into its proper shape, which it ever afterwards retains. While the canoe is still soft and pliant, several slight cross-pieces are inserted, so as to counteract any tendency towards warping. The outside of the vessel is then hardened by fire, so as to enable it to resist the attacks of insects, and also to prevent it cracking when exposed to the sun. The inside is then painted some bright colour, and the outside is usually black and highly polished. This is produced by rubbing it with oil after the fire has done its work. Lastly, a pattern is painted on its bow. There is no keel to the boat. The red pattern of the painting is obtained by a preparation of *anato*. For boring holes the Ahts use a drill formed by a bone of a bird fixed in a wooden handle.

A precisely similar process to this is employed in the formation of the Burmese dug-out canoes, and has thus been described to me by Capt. O'Callaghan, who witnessed the process during the Burmese War in 1852. A trunk of a tree of suitable length, though much less in diameter than the intended width of the boat, is cut into the usual form, and hollowed out. It is then filled with water, and fires are lit, a short distance from it, along its sides. The water gradually swells the inside, while the fire contracts the outside, till the width is greatly increased. The effect thus produced is rendered permanent by thwarts being placed so as to prevent the canoe from contracting in width as it dries; the depth of the boat is increased by a plank at each side, reaching as far as the ends of the hollowed part. Canoes generally show traces of the fire and water treatment just described, the inner surface being soft and full of superficial cracks, while the outer is hard and close.

It is probable that this mode of bending canoes has been discovered during the process of cooking, in which red-hot stones are used in many countries to boil the water in vessels of skin or wood, in which the meat is cooked. No. 1256 of my collection is a model of an Aht canoe, painted as here described. No. 1257 is a full-sized canoe from this region, made out of a single trunk; it is not painted, so that the grain of the wood can be seen.

The distribution of the dug-out canoe appears to be almost universal. It is especially used in southern and equatorial regions. Leaving Australia, we find it employed with the outrigger, which will be described hereafter (pp. 218–9), in many parts of the Polynesian and Asiatic islands, including New Guinea, New Zealand, New Caledonia, and the Sandwich Islands. It was not used by the natives of Tasmania, who employed a float consisting of a bundle of bark and rushes, which will be described in another place (p. 203). Wilkes speaks of it in Samoa, at Manilla, and the Sooloo Archipelago. De Guignes in 1796 and De Morga in 1609 saw them in the Philippines, where they are called *pangues*, some carrying from two to three and others from twelve to fifteen persons. They are (or were) also used in the Pelew, Nicobar, and Andaman Isles. In the India Museum there is a model of one from Assam, used as a mail boat, and called *dák nao*. In Burmah, Symes, in 1795, describes the war-boats of the Irrawaddy as 80 to 100 feet long, but seldom exceeding 8 feet in width, and this only by additions to the sides;

carrying fifty to sixty rowers, who use short oars that on a spindle, and who row instead of paddling. Cap O'Callaghan, however, informs me that they sometimes paddles (Nos. 1276 and 1277). They are made of one piec the teak tree. The king had five hundred of these vessel war. They are easily upset, but the rowers are taught to a being struck on the broadside; they draw only 3 fee water. On the Menan, in Siam, Turpin, in 1771, says that king's *ballons* are made of a single tree, and will contain rowers; the two ends are very much elevated, and the ro sit cross-legged, by which they lose a great deal of power. river vessels in Cochin China are also described as being of same long, narrow kind. At Ferhabad, in Persia, Pietro Valle, in 1614, describes the canoes as being flat-botto hollow trees, carrying ten to twelve persons.

In Africa, Duarte Barbosa, in 1514, saw the Moors at Zu make use of boats, *almadias*, hollowed out of a single trun bring clothes and other merchandise from Angos. Livingst says the canoes of the Bayeye of South Africa are hollow t made for use and not for speed. If formed of a crooked s they become crooked vessels, conforming to the line of timber. On the Benuwé, at its junction with the [Y Barth, for the first time in his travels southward, saw he describes as rude little shells hollowed out of a si tree; they measured 25 to 30 feet in length, 1 to 1½ in height, and 16 inches in width; one of them, he s was quite crooked. On the White Nile, in Unyoro, G says that the largest canoe carried a ton and a half, and hollowed out of a trunk. On the Kitangule, west of Victoria Nyanza, near Karague, he describes the canoes being hollowed out of a log of timber 15 feet long and breadth of an easy-chair. These kind of canoes are also by the Makoba east of Lake Ngami, by the Apingi and Cam and the Krumen of the West African coast; of which No. 1272 of my collection is a model.

In South America the Patagonians use no canoes, but in northern parts of the continent dug-out canoes are com One described by Condamine, in 1743, was from 42 to feet long, and only 3 feet wide. They are also used

Guiana, and Professor Wilson says that the dug-out canoe is used throughout the West Indian Archipelago. According to Bartram, who is quoted by Schoolcraft, the large canoes formed out of the trunks of cypress trees, which descended the rivers of Florida, crossed the Gulf, and extended their navigation to the Bahama Isles, and even as far as Cuba, carrying twenty to thirty warriors. Kalm, in 1747, gives some details respecting their construction on the Delaware river already referred to (p. 191), and says that the materials chiefly employed in North America are the red juniper, red cedar, white cedar, chestnut, white oak, and tulip tree. Canoes of red and white cedar are the best, because lighter, and they will last as much as twenty years, whereas the white oak barely lasts above six years. In Canada these dug-outs were made of the white fir. The process of construction on the west coast of North America has been already described (p. 192).

In Europe Pliny mentions the use of canoes hollowed out of a single tree by the Germans. Amongst the ancient Swiss lake-dwellers at Robenhausen, associated with objects of the stone age, a dug-out canoe, or *Einbaum*, made of a single trunk 12 feet long and 2½ wide, was discovered (Keller, *Lake Dwellings*, Lee², p. 45). In Ireland, Sir William Wilde says that amongst the ancient Irish dug-out canoes were of three kinds. One was small, trough-shaped, and square at the ends, having a projection at either end to carry it by; the paddlers sat flat at the bottom and paddled, there being no rowlocks to the boat. A second kind was 20 feet in length and 2 in breadth, flat-bottomed, with round prow and square stern, strengthened by thwarts carved out of the solid and running across the boat, two near the stem and one near the stern. The prow was turned up; one of these was discovered in a bog on the coast of Wexford, 12 feet beneath the surface. The third sort was sharp at both ends, 21 feet long, 12 inches broad, and 8 inches deep, and flat-bottomed. These canoes are often found in the neighbourhood of the crannoges, or ancient lake-habitations of the country, and were used to communicate with the land; also in the beds of the Boyne and Bann. Ware says, that dug-out canoes were used in some of the Irish rivers in his time, and to this day I have seen paddles used on the Blackwater, in the south of Ireland. Professor Wilson says that several dug-out canoes have been found in the ancient river-deposits of the Clyde, and also in the neighbourhood of Falkirk. In one of those discovered in the Clyde deposits, at a depth of 25 feet from the surface, a stone almond-shaped celt was found. Others have been found in the ancient river-deposits of Sussex and elsewhere, in positions which show that the rivers must probably have formed arms of the sea, at the time they were sunk.

2. *Vessels in which the Planks are Stitched to each Other.*

All vessels of the dug-out class are necessarily long and narrow, and very liable to upset; the width being limited by the size of the tree, extension can only be given to them by increasing their length. In order to give greater height and width to these boats, planks are sometimes added at the sides and stitched on to the body of the canoe by means of strings or cords, composed frequently of the bark or leaves of the tree of which the body is made. In proportion as these laced-on gunwales were found to answer the purpose of increasing the stability of the vessel, their number was increased; two such planks were added instead of one, and as the joint between the planks was by this means brought beneath the water line, means were taken to caulk the seams with leaves, pitch, resin, and other substances. Gradually the number of side planks increased and the solid hull diminished, until, ultimately, it dwindled into a bottom-board, or keel, at the bottom of the boat, serving as a centre-piece on which the sides of the vessel were built. Still the vessel was without ribs or framework; ledges on the sides were carved out of the solid substance of each plank, by means of which they were fastened to the ledges of the adjoining plank, and the two contiguous ledges served as ribs to strengthen the boat; finally, a framework of vertical ribs was added to the interior and fastened to the planks by cords. Ultimately the stitching was replaced by wooden pins, and the side planks pinned to each other and to the ribs; and these wooden pins in their turn were supplanted by iron nails.

In different countries we find representations of the canoe in all these several stages of development. Of the first stage, in which side planks were added to the body of the dug-out canoe, to heighten it, the New Zealand canoe, No. 1259 of my collection, is an example. Capt. Cook describes this as solid, the largest containing from thirty men upwards. One measured 70 feet in length, 6 in width, and 4 deep. Each of the side pieces was formed of an entire plank, about 12 inches wide, and about 1½ inch thick, laced on to the hollow trunk of the tree by flaxen cords, and united to the plank on the opposite side by thwarts across the boat. These canoes have names given to them like European vessels.

On the Benuwé, in Central Africa, Barth describes a vessel in this same early stage of departure from the original dug-out trunk. It consisted of 'two very large trunks joined together with cordage, just like the stitching of a shirt, and without pitching, the holes being merely stuffed with grass. It was not water-tight, but had the advantage,' he says, 'over the dug-out canoes used on the same river, in not breaking if it came upon a rock, being, to a certain degree, pliable. It was 35 feet long, and 26 inches wide in the middle.' No. 1258 of my collection is a model of one of these. The single plank added to the side of the Burmese dug-out canoe has been already noticed (p. 193). Although my informant does not tell me that these side planks are sewn on, I have no doubt, judging by analogy, that this either is or was formerly the case.

The Waraus of Guiana are the chief canoe-builders of this part of South America, and to them other tribes resort from considerable distances. Their canoe is hollowed out of a trunk of a tree, and forced into its proper shape partly by means of fire and partly by wedges, upon a similar system to that described in speaking of the Ahts of North America (p. 192) and the Burmese; the largest have the sides made higher by a narrow plank of soft wood, which is laced upon the gunwale, and the seam caulked. This canoe is alike at both ends, the stem and stern being pointed, curved, and rising out of the water; there is no keel, and it draws but a few inches of water. This appears to be the most advanced stage to which the built-up canoe has arrived on either continent of America, with the exception of Tierra del Fuego, where Commodore Byron, in 1765, saw canoes in the Straits of Magellan made of planks sewn together with thongs of raw hide; these vessels are considerably raised at the bow and stern, and the larger ones are 15 feet in length by 1 yard wide. They have also been described by more recent travellers. Under what conditions have these miserable Fuegians been led to the employment of a more complex class of vessel than their more advanced congeners of the north ?

In order to trace the further development of the canoe in this direction, we must return to Africa and the South Seas. On the island of Zanzibar, Barbosa, in 1514, says that the inhabitants of this island, and also Penda and Manfia, who are Arabs, trade with the mainland by means of 'small vessels very loosely and badly made, without decks, and with a single mast; all their planks are sewn together with cords of reed or matting, and the sails are of palm mats'. On the river Yeou, near Lake Tchad, in Central Africa, Denham and Clapperton saw canoes 'formed of planks, rudely shaped with a small hatchet, and strongly fastened together by cords passed through holes bored in them, and a wisp of straw between, which the people say effectually keeps out the water; they have high poops like the Grecian boats, and would hold twenty or thirty persons'. On the Logon, south-east of Lake Tchad, Barth says the boats are built 'in the same manner as those of the Budduma, except that the planks consist of stronger wood, mostly *Birgem*, and generally of larger size, whilst those of the Budduma consist of the frailest material, viz. *Fogo*. In both, the joints of the planks are provided with holes, through which ropes are passed, overlaid with bands of reed tightly fastened upon them by smaller ropes, which are again passed through small holes stuffed with grass.' On the Victoria Nyanza, in East Central Africa, Grant speaks of 'a canoe of five planks sewn together, and having four cross-bars or seats. The bow and stern are pointed, standing for a yard over the water, with a broad central plank from stem to stern, rounded outside (the vestige of the dug-out trunk), and answering for a keel.'

Thus far we have found the planks of the vessels spoken of, merely fastened by cords passed through holes in the planks, and stuffed with grass or some other material, and the accounts speak of their being rarely water-tight. Such a mode of constructing canoes might serve well enough for river navigation, but would be unserviceable for sea craft. Necessity is the mother of invention, and accordingly we must seek for a further development of the system of water-tight stitching, amongst those races in a somewhat similar condition of culture, which inhabit the islands of the Pacific and the borders of the ocean between it and the continent of Africa.

The majority of those vessels now to be described are furnished with the outrigger; but as the distribution of this contrivance will be traced subsequently (p. 218 ff.), it will not be necessary to describe it in speaking of the stitched plank-work.

In the Friendly Isles Captain Cook, in 1773, says 'the canoes are built of several pieces sewed together with bandage in so neat a manner that on the outside it is difficult to see the joints. All the fastenings are on the inside, and pass through *kants* or ridges, which are wrought on the edges and ends of the several boards which compose the vessel.' At Otaheite he speaks of the same process, and says that the chief parts are formed separately without either saw, plane, or other tool. La Perouse gives an illustration of an outrigger canoe from Easter Island, the sides of which are formed of drift-wood sewn together in this manner. At Wytoohee, one of the Paumotu, or Low Archipelago, Wilkes, in 1838, says that the canoes are formed of strips of cocoa-nut tree sewed together. Speaking of those of Samoa, he describes the process more fully. 'The planks are fastened together with *sennit*; the pieces are of no regular size or shape. On the inside edge of each plank is a ledge or projection, which serves to attach the sennit, and connect and bind it closely to the adjoining one. It is surprising,' he says, 'to see the labour bestowed on uniting so many small pieces together, when large and good planks might be obtained. Before the pieces are joined, the gum from the husk of the bread-fruit tree is used to cement them close, and prevent leakage. These canoes retain their form much more truly than one would have imagined; I saw few whose original model had been impaired by service. On the outside the pieces are so closely fitted as frequently to require close examination before the seams can be detected. The perfection of workmanship is astonishing to those who see the tools with which it is effected. They consist now of nothing more than a piece of iron tied to a stick, and used as an adze; this, with a gimlet, is all they have, and before they obtained their iron tools, they used adzes made of hard stone and fish-bone.' The construction of the Fiji canoe, called *drua*, is described by Williams in great detail. A keel or bottom board is laid in two or three pieces, carefully scarfed together. From this the sides are built up, without ribs, in a number of pieces varying from three to twenty feet. The edges of these pieces are fastened by ledges, tied together in the manner already described. A white pitch from the bread-fruit tree, prepared with an extract from the coco-nut kernel, is spread uniformly on both edges, and a fine strip of *masi* laid between. The binding of sennit with which the boards, or *vanos*, as they are called, are stitched together is made tighter by small wooden wedges inserted between the binding and the wood, in opposite directions. The ribs seen in the interior of these canoes are not used to bring the planks into shape, but are the last things inserted, and are for uniting the deck more firmly with the body of the canoe. The carpenters in Fiji constitute a distinct class, and have chiefs of their own. The Tongan canoes were inferior to those of Fiji in Captain Cook's time, but they have since adopted Fiji patterns. The Tongans are better sailors than the Fijians. Wilkes describes a similar method of building vessels in the Kingsmill Islands, but with varieties in the details of construction. 'Each canoe has six or eight timbers in its construction; they are well modelled, built in frames, and have much sheer. The boards are cut from the coco-nut tree, from a few inches to six or eight feet long, and vary from five to seven inches in width. These are arranged as the planking of a vessel, and very neatly put together, being sewed with sennit. For the purpose of making them water-tight they use a slip of pandanus leaf, inserted as our coopers do in plugging a cask. They have evinced much ingenuity,' he says, 'in attaching the uprights to the flat timbers.' It is difficult, without the aid of drawings, to understand exactly the peculiarities of this variety of construction, but he says they are secured so as to have all the motion of a double joint, which gives them ease, and comparative security in a seaway.

Turning now to the Malay Archipelago, Wallace speaks of a Malay *prahau* in which he sailed from Macassar to New Guinea, a distance of 1,000 miles, and says that similar but smaller vessels had not a single nail in them. The largest of these, he says, are from Macassar, and the Bugi countries of the Celebes and Boutong. Smaller ones sail from Ternate, Pidore, East Ceram, and Garam. The majority of these, he says, have stitched planks. No. 1268 of my collection is a model of a vessel employed in those seas. Wallace says that the inhabitants of Ke Island, west of New Guinea, are the best boat-builders in the archipelago, and several villages are constantly employed at the work. The planks here, as in the Polynesian Islands, are all cut out of the solid wood, with a series of projecting ledges on their edges in the inside. But here we find an advance upon the Polynesian system, for the ledges of the planks are pegged to each other with wooden pegs. The planks, however, are still fastened to the ribs by means of *rattans*. The principles of construction are the same as in those of the Polynesian Islands, and the main support of the vessel still consists in the planks and their ledges, the ribs being a subsequent addition; for he says that after the first year the rattan-tied ribs are generally taken out and replaced by new ones, fitted to the planks and nailed, and the vessel then becomes equal to those of the best European workmanship. This constitutes a remarkable example of the persistency with which ancient customs are retained, when we find each vessel systematically constructed, in the first instance, upon the old system, and the improvement introduced in after years. I wonder whether any parallel to this could be found in a British arsenal. The psychical aspect of the proceeding seems not altogether un-English.

Extending our researches northward, we find that Dampier, in 1686, mentions, in the Bashee Islands, the use of vessels in which the planks are fastened with wooden pins. On the Menan, in Siam, Turpin, in 1771, speaks of long, narrow boats, in the construction of which neither nails nor iron are employed, the parts being fastened together with roots and twigs which withstand the destructive action of the water. They have the precaution, he says, to insert between the planks a light, porous wood, which swells by being wet, and prevents the water from penetrating into the vessel. When they have not this wood, they rub the chinks, by which the water enters, with clay. In the India Museum there is a model of a very early form of vessel from Burmah, described as a trading vessel. The bottom is dug out, and the sides formed of planks laced together. A large stone is employed for an anchor. Here we see that an inferior description of craft has survived, upon the rivers, in the midst of a higher civilization which has produced a superior class of vessel upon the seas.

Turning westward, we have the surf-boat of Madras, called *massoola*, which, on account of its elasticity, is still used on the seashore. Its parts are stitched together in the manner represented in the model, No. 1267 of my collection. On the Malabar coast the ships of the Pardesy, who consisted of Arabs, Persians, and others who have settled in the kingdom of Malabar, are described by Barbosa in 1514. They build ships, he says, of 200 tons, which have keels like the Portuguese, but have no nails. They sew their planks with neat cords, very well pitched, and the timber very good. Ten or twelve of these ships, laden with goods, sail every year in February for the Red Sea, some for Aden and some for Jeddah, the port of Mecca, where they sell their merchandise to others, who transmit it to Cairo, and thence to Alexandria. The ships return to Calicut between August and October of the same year. The earliest description we have of these vessels in this part of the world, in historic times, is in the account of the travels of two Mahomedans in the ninth century. In these travels it is related that there were people in the Gulf of Oman who cross over to the islands that produce coco-nuts, taking with them their tools, and make ships out of it. With the bark they make the cordage to sew the planks together, and of the leaves they make sails; and having thus completed the vessel, they load it with coco-nuts and set sail. Marco Polo, at the commencement of the fourteenth century, confirms this, and says, speaking of the ships at Ormuz, in the Persian Gulf, that they do not use nails, but wooden pins, and fasten them with threads made of the Indian nut. These threads endure the force of the water, and are not easily corrupted thereby. These ships have one mast, one sail, *and one beam*, and are covered with but one deck. They are not caulked with pitch, but with the oil and fat of fishes. When they cross to India they lose many ships, because the sea is very tempestuous, and they are not strengthened with iron. In the Red

Sea, Father Lobo, in 1622, describes the vessels called *gelves*, which, he says, are made almost entirely of the coco-nut tree. The trunk is sawn into planks, the planks are sewn together with thread which is spun from the bark, and the sails are made of the leaves stitched together. They are more convenient, he says, than other vessels, because they will not split if thrown upon banks or against rocks.

We have now arrived in the region which is usually regarded as the cradle of Western civilization, certainly the land in which Western culture first began to put forth its strong shoots; and we must expect to find that the art of shipbuilding advanced in the same ratio as other trades. But, unlike the Phoenicians, the Egyptians confined their navigation chiefly to the Nile, and had an abhorrence of Typhon, as they termed the sea, because it swallowed up the great river, which, being the chief source of their prosperity, they regarded as a god.

Here it may be desirable to digress for one moment from the chain of continuity which we have been following, in order to say a few words about the most primitive form of vessel used on the Nile, viz. that mentioned by Isaiah (xviii. 2) as being of Ethiopian origin, the vessel of bulrushes to which the mother of Moses entrusted her infant progeny. What the coco-nut tree was to the navigators on the eastern seas, the papyrus was to the Egyptians, and from it every part of the vessel—rope, planks, masts, and sails—was constructed. Adverting to the earliest and simplest of these papyrus vessels, the common use for a bundle of faggots, for such it was, is not, perhaps, one of those coincidences which, viewed by the light of modern culture, we should select as evidence of connexion between distant lands. And yet there are peculiarities of form which make the bulrush float of the Egyptians worthy of comparison with those used in the rivers of Australia.

The Australian float, as represented by a model in the British Museum, consisted of a bundle of bark and rushes, pointed and elevated at the ends, and bound round with girdles of the same material. The only vessel, according to Mr. Calder, used in Tasmania, on the west coast, is thus described by him in the *Journal of the Anthropological Institute*, iii. 22. 'It was of considerable size, and something like a whale-boat, that is, sharp-sterned, but a solid structure, and the natives, in their aquatic adventures, sat on the top of it. It was generally made by the buoyant and soft, velvety bark of the swamp tea-tree (*Melaluca* sp.), and consisted of a multitude of small strips bound together.' Professor Wilson says that the Californian canoe consists of a mere rude float, made of rushes, 'in the form of a lashed-up hammock.' A woodcut in Sir Gardner Wilkinson's *Ancient Egypt*, No. 399 of his work, represents three persons making one of these papyrus floats. It is the *baris*, or Memphite bark, bound together with papyrus, spoken of by Lucan, and it is of precisely similar form to those above described, elevated and pointed at the ends, and the men are in the act of binding it round with girdles. This is the kind of boat in which Plutarch describes Isis going in search of the body of Osiris through the fenny country; a bark made of papyrus. Pliny attributes the origin of shipbuilding to these vessels (vii. 56); and speaks (vi. 22) of their crossing the sea and visiting the Island of Taprobane (Ceylon, according to Sir G. Wilkinson); but it seems probable that he must refer to a more advanced form of vessel than the mere bulrush float.

The racial connexion between the Australians and the Egyptians, first put forward by Professor Huxley, has hardly met with general acceptance as yet; but, startling as it at first sight appeared, the more we look into the evidence bearing upon it, the less improbable, to say the least, it becomes, when viewed by the light of comparative culture. I have already shown, in another place,[1] how closely some of the Australian weapons correspond to some of those still used on the Upper Nile, and the remarkable resemblance here pointed out in a class of vessels which might well have been used in passing short distances from island to island of the now submerged fragments of land that are supposed to have formerly existed in parts of the southern hemisphere, is, at least, worthy of attention amongst other evidence of the same kind that may be collected, although I fully admit that it is not of a character to stand alone. I will not exceed my province by attempting to defend the theory of the Australioid origin of the Egyptians on physical grounds, preferring to leave the defence of that theory in the hands of its author, who is so well able to support his own views; but I may take this opportunity of commenting on some remarks made by Professor Owen in his valuable paper, published in the last number of our *Journal*, on the psychical evidence of connexion between them and the black races of the southern hemisphere. Adverting to the fresco painting, in the British Museum, of the ancient Egyptian fowler, who holds in his hand a stick, which he is in the act of throwing at a flock of birds, I am inclined to agree with Professor Owen in thinking there is nothing in its shape to denote that it is a boomerang. Other figures, however, in Rosellini's *Egyptian Monuments*, show the resemblance more clearly, and if these are not enough, the specimen of the weapon itself in the glass case in the Egyptian room of the British Museum proves the identity of the weapon beyond possibility of doubt. I have elsewhere stated at length,[1] that having made several facsimiles of this weapon from careful measurements, so as to obtain the exact size, form, and weight of the original, for the purpose of experiment, I found that it possessed all the properties of the Australian boomerang, rising in the air, and returning in some cases to within a few paces of the position from which it was thrown. In fact, it was easier to obtain the return flight from this weapon than from many varieties of the Australian boomerang, with which I experimented at the same time.

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[1] 'Primitive Warfare,' pp. 127–30, 148–51, above.

But supposing the ancient Egyptian to be 'convicted of the boomerang', says the learned professor, 'common sense repudiates the notion of the necessity of inheritance in relation to such operations.' Against this I would urge, that the application of the general quality of common sense to the determination of questions of psychical connexion, between races so far removed from us, as the Australians or the predecessors of the earliest Egyptian kings, is inconsistent with all that we know of the phenomena of mental evolution in man, seeing that there must necessarily be many stages of disparity between them and any intelligent member of the Anthropological Institute to whose common sense this appeal was made.

If the common sense of the nineteenth century does not repudiate the fact that the steam engine, the electric telegraph, vaccination, free trade, and a thousand other contrivances for the benefit of our race, have sprung from special centres, and have been inherited, or otherwise received, by the highly cultivated races to which they have spread in modern times, neither would the common sense of the Australian or prehistoric Egyptian, after its kind, bar the likelihood of such contrivances as the boomerang, the parrying-shield, or the 'baris' having been handed from one savage people to another in a similar manner. Wherever two or three concurrent chains of connexion, whether of race, language, or the arts, can be traced along the same channel, such evidence is admissible, and is indeed frequently the only evidence available in dealing with prehistoric times.

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[1] Address to the Anthropological Department at the Brighton meeting of the British Association, 1872. *Report Brit. Assoc.* (London, 1873), p. 161.

The peculiar elevated ends of the papyrus floats are almost identical in form, but not in structure, with those now used in parts of India, especially on the Ganges; and the word *juak* is said to be related to *juncus*, a bulrush. Somewhat similar rafts, but flat, turned up in front but not behind, and called *tankwa*, are described by Lieut. Prideaux as being still used on Lake Tsana, in Soudan, and they are also used by the Shillooks, who make them of a wood as light as cork, called *ambads* (*Anemone mirabilis*). A paper by Mr. John Hogg, in the *Magazine of Natural History* (1829, ii. p. 324 ff.), to which my attention has been kindly drawn by Mr. John Jeremiah, contains some useful information on the subject of Egyptian papyrus vessels. Denon describes and figures a very primitive float of this sort, consisting of a bundle of straw or stalks, pointed and turned up in front, and says that the inhabitants of the Upper Nile go up and down the river upon it astride, the legs serving for oars; they use also a short double-bladed paddle. It is worthy of notice that the only other localities, that I am aware of, in which this double paddle is used, are the Sooloo Archipelago and among the Esquimaux. Belzoni also describes the same kind of vessel. Mr. Hogg, in his paper, gives several illustrations of improved forms of these solid papyrus floats, derived from a mosaic pavement discovered in the Temple of Fortune at Praeneste. From these it seems that they were bound round with thongs, pointed, and turned up and over at both ends. But Bruce, in 1790, describes more particularly the class of vessel used in Abyssinia in his time, called *tankwa*, or, as he writes it, *tancoa*, and says that it corresponds exactly to the description of Pliny (*Nat. Hist.*, xiii. 2, compare v. 9). His description appears possibly to indicate that there was a separate line of development of hollow vessels derived from the flat raft. A piece of acacia tree was put in the bottom to serve as a keel, to which plants were joined, being first sewed together, then gathered up at the ends and stern, and the ends of the plant tied fast there. On Lake Tsana they are only turned up in front: see above. Belzoni describes a similar kind of vessel on Lake Moeris, which seems clearly to be hollow. The outer shell or hulk was composed of rough pieces of wood, scarcely joined, and fastened by four other pieces wrapped together by four more across, which formed the deck; no tar, no pitch, either inside or out, and the only preventive against the water coming in was a kind of weed which had settled in the joints of the wood. The only other locality, that I know of, in which similar vessels to these are used, is Formosa, a description of which is given by Mr. J. Thomson (*The Straits of Malacca, Indo-China, and China*, London, 1875, p. 304), for the sight of which I am indebted to Mr. W. L. Distant. He says: 'We went ashore in a catamaran, a sort of raft made of poles of the largest species of bamboo. These poles are bent by fire, so as to impart a hollow shape to the raft, and are lashed together with rattan. There is not a nail used in the whole contrivance.'

But the boats 'woven of' the papyrus, mentioned by Pliny, certainly refer to something more complex than the papyrus bundle above described. Lucan describes them as being sewn with bands of papyrus, and Herodotus describes them more fully. This passage has been variously translated by different authors, but the version given by Sir Gardner Wilkinson is as follows:—'they cut planks measuring about two cubits, and having arranged them like bricks, they build the boat in the following manner: they fasten the planks round firm long pegs, and, after this, stretch over the surface a series of girths, *but without any ribs*, and the whole is bound *within* by bands of papyrus.' The exact meaning of this is obscure; but I would suggest, that as the 'fastening within' clearly shows it was not a solid structure, the more reasonable interpretation of it is by supposing that the planks, arranged in brick fashion, were fastened on the inside by cords, in the manner practised in the South Sea Islands and elsewhere. What the long pins were is uncertain; but as Sir Gardner Wilkinson says that the models found in the tombs show that ribs were used at a time probably subsequent to this, these pins may have been rudimentary ribs of some kind, and they also may have been 'bound within' to the planks in the same manner. It seems not unlikely that these boats may have also been bound round on the outside to give them additional strength, after the manner of the papyrus floats above described.[1] With this vessel, which was called *baris*, they used a sort of anchor, consisting of a stone with a hole in it, similar to one on a Burmese vessel, of which a model is in the India Museum.

The larger class of Egyptian vessels were of superior build, the planks being fastened with wooden pins and nails, and their construction somewhat similar to those still used on the Nile.

Returning now to the link of the chain to which we have appended this digression, and carrying our inquiries further northward into the area of Western civilization, it is to be expected that we should lose all trace of this primitive mode of ship-building. The earliest vessels recorded in classical history were fastened with nails. In Homer's description of the vessel built by Odysseus, both nails and ribs were employed, and it had a round or a flat bottom (Smith's *Dict.*). No trace of any earlier form of ship has been discovered in Europe, until we come to the neighbourhood of the North Sea. Here, in the Nydam Moss, in Slesvic, in 1863, was discovered a large boat, seventy-seven feet long, ten feet ten inches broad in the middle, flat at the bottom, but higher and sharper at both ends, having a prow at both ends, like those described by Tacitus as having been built by the Suiones, who inhabited this country and Sweden in ancient times. This vessel, from its associated remains, has been attributed to the third century A. D. The bottom consisted of a broad plank, about two feet broad in the middle, but diminishing in width towards each end. A small keel, eight inches broad and one deep, was carved on the under side of the plank, which corresponds to the bottom plank, which, in Africa and the Polynesian Islands, we have shown to be the vestige of the dug-out trunk. On to this bottom plank, five side planks, running the whole length of the vessel, were built, but they differed from those previously described in overlapping, being clinker-built, and attached to each other, not by strings or wooden pins, but by large iron bolts. The planks, however, resembled those of the southern hemisphere, in having clamps or ledges carved out of the solid on the inside; these ledges were perforated, and their position corresponded to rows of vertical ribs, to which, like the vessels at Ke Island, and elsewhere in the Pacific, they were *tied* by means of cords passing through corresponding holes in the ribs. Each rib was carved out of one piece, and, like those of Ke Island in the Asiatic Archipelago, could easily have been taken out and replaced by others after the vessel was completed. In short, the vessel represented the particular stage of development which may be described as plank-nailed and rib-tied, or which might be characterized as having removable ribs; differing in this respect from the more advanced system of modern times, in which the ribs, together with the keel, form a framework to which the planks are afterwards bent and fastened.

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[1] Since writing this I have seen the illustration in Sir H. Rawlinson's note to this passage, in which he gives it as his opinion that this is the meaning and use to be ascribed to these pins; and he says that this system is still employed in Egypt, where they raise an extra bulwark above the gunwale. Rawlinson, *Herodotus* (1862), vol. ii. p. 132.

This mode of fastening the ribs to ledges carved out of the planking, Mr. Engelhardt, to whom we are indebted for the accurate drawings and description of this vessel,[1] remarks, is a most surprising fact, considering that the people who constructed the boat are proved by the associated remains to have been not only familiar with the use of iron, but to have been able to produce damascened sword-blades. But this fact, which, taken by itself, has been justly described as surprising, analogy leads us to account for, by supposing these particular parts of the vessel to have been survivals from a universally prevalent primitive mode of fastening, the nearest southern representative of which, at the present time, is to be found in the Red Sea and adjoining oceans. Nor can there be any reason to doubt, I think, that this mode of constructing vessels may have been used in the intervening countries, which have been the scene of the rise of Western civilization since the earliest times, but which have now lost all trace of the most primitive phases of the art of ship-building.

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[1] *Denmark in the Early Iron Age*, by Conrad Engelhardt (London, 1866), p. 31.

Mr. Engelhardt, however, traces a connexion between this ancient vessel, found in the Nydam Moss, and the Northland boats now used on the coast of Norway and the Shetland Isles, the peculiar rowlocks of which, and also the clincher-nails by which the sides are fastened, correspond very closely to those of the Nydam boat. Here also, and in Finland and Lapland, we find survivals of a still earlier mode of ship-building, corresponding to the more primitive plank-stitched vessels, before described, in so many places in the southern hemisphere. Regnard, in 1681, describes the Finland boats as being twelve feet long and three broad. They are made of fir, and fastened together with the sinew of the reindeer; this makes them, he says, so light that one man can carry one on his shoulders; others are fastened together with thread made of hemp, rubbed with glue, and their cords are of birch bark or the root of the fir. Outhier, in 1736, confirms this account of the manner in which they are sewn together, and says that it renders them very flexible, and suitable for passing cataracts, on account of their lightness, and because they do not break when they are cast against a rock. The Lapland sledge called *pulea* is also described by Regnard as being of the same construction—boat-shaped, and the parts sewn together with the sinew of the reindeer, without a single nail. I have not as yet been able to trace this mode of fastening vessels continuously in Russia; but Bell, in 1719, says that the long, flat-bottomed barks used on the Volga for carrying salt have not a single iron nail in their whole fabric; and Atkinson describes vessels on the Tchoussowaia which are built without nails, but these are fastened with wooden pins.

3. *Bark canoes.*

The use of bark for canoes might have been suggested by the hollowed trunk; but, on the other hand, we find this material employed in Australia, where the hollowed trunk is not in general use. Bark is employed for a variety of purposes, such as clothing, materials for huts, and so forth. Some of the Australian shields are constructed of the bark of trees. The simplest form of canoe in Australia consists, as already mentioned (p. 203), of a mere bundle of reeds and bark pointed at the ends. It is possible that the use of large pieces of bark in this manner may have suggested the employment of the bark alone. Belzoni mentions crossing to the island of Elephantine, on the Nile, in a ferry-boat which was made of branches of palm trees, fastened together with cords, and covered on the outside with a mat pitched all over. The solid papyrus boats represented on the pavement at Praeneste, before mentioned, have evidently some other substance on the outside of them; and Bruce imagines that the junks of the Red Sea were of papyrus, covered with leather.[1] The outer covering would prevent the water from soaking into the bundle of sticks, and thus rendering it less buoyant. Bark, if used in the same manner, would serve a like purpose, and thus suggest its use for canoe-building. Otherwise I am unable to conceive any way in which bark canoes can have originated, except by imitation of the dug-out canoe.

For crossing rivers, the Australian savage simply goes to the nearest stringy-bark tree, chops a circle round the tree at the foot, and another seven or eight feet higher, makes a longitudinal cut on each side, and strips off bark enough by this means to make two canoes. If he is only going to cross the river by himself, he simply ties the bark together at the ends, paddles across, and abandons the piece of bark on the other side, knowing that he can easily provide another. If it is to carry another besides himself, he stops up the tied ends with clay; but if it is to be permanently employed, he sews up the ends more carefully, and keeps it in shape by cross-pieces, thereby producing a vessel which closely resembles the bark canoe of North America (Wood, *Nat. Hist. of Man*, ii. 103). I have not been able to trace the use of the bark canoe further north than Australia on this side of the world, probably owing to its being ill adapted for sea navigation; nor do I find representatives of it in any part of Europe or Africa, although bark is extensively used, in the Polynesian Islands and elsewhere, for other purposes.

It is the two continents of America which must be regarded as the home of the bark canoe.

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[1] 'On Vessels of Papyrus,' by John Hogg, Esq., M.A., F.L.S.; *Magazine of Nat. Hist.*, vol. ii (1829), pp. 324–32: cf. p. 206, above.

The Fuegian canoe has been described by Wilkes, Pritchard, and others. It is sewn with shreds of whalebone, sealskin, and twigs, and supported by a number of stretchers lashed to the gunwale; the joints are stopped with rushes, and, without, smeared with resin. In Guiana the canoe is made of the bark of the purple-heart tree, stripped off and tied together at the ends. The ends are stopped with clay, as with the Australians. This mode of caulking is not very effectual, however, and the water is sure to come in sooner or later.

The nature of the material does not admit of much variety in the construction; suffice it to say that it is in general use in North America, up to the Esquimaux frontier. Its value in these regions consists in the facility with which it is taken out of the water and carried over the numerous rapids that prevail in the North American rivers. The Algonquins were famous for the construction of them. Some carry only two people, but the *canot de maître* was thirty-six feet in length, and required fourteen paddlers. Kalm, in 1747, gives a detailed account of the construction of them on the Hudson river, and Lahontan, in 1684, gives an equally detailed description of those used in Canada. The bark is peeled off the tree by means of hot water. They are very fragile, and every day some hole in the bottom has to be stopped with gum.

Mr. T. G. B. Lloyd, in an excellent paper descriptive of the Beothucs of Newfoundland, published in *Journ. Anthrop. Inst.* (vol. iv. pp. 26–8), has described the remarkable bark canoe of these people. Its form is different from any other canoe of this or any other region that I have heard of, the line of the gunwale rising in the middle, as well as at the ends, and the vessel being V-shaped in section, with a straight wooden keel at the bottom. Its form is so singular, that the only idea of continuity which I can set up for it is, that it must have been copied from some European child's paper boat, capable, by a single additional fold, of being converted into a cocked hat; the central pyramidal portion of the paper boat having given the form to the pyramidal sides of the Beothuc vessel. If this be rejected, then its history has yet to be told, for no native tribe ever employed such a peculiar form unless by inheritance.

Nos. 1248 and 1249 of my collection are South American bark canoes; Nos. 1250 to 1252 are bark canoes from North America.

4. *Canoes of Wicker and Skin.*

As we approach the Arctic regions, the dug-out and bark canoes are replaced by canoes of skin and wicker. As we have already seen, in the case of the bow, and other arts of savages, vegetable materials supply the wants of man in southern and equatorial regions, whilst animal materials supply their place in the north.

The origin of skin coverings has been already suggested when speaking of bark canoes. The accidental dropping of a skin bottle into the water might suggest the use of such vessels as a means of recovering the harpoon, which, as I have already shown elsewhere, was almost universally used for fishing in the earliest stages of culture. The Esquimaux lives with the harpoon and its attached bladder almost continually by his side. The Esquimaux *kayak*, Nos. 1253 and 1254 of my collection, in which he traverses the ocean, although admirable in its workmanship, and, like all the works of the Esquimaux, ingenious in construction, is in principle nothing more than a large, pointed bladder, similar to that which is lashed to the harpoon at its side; the man in this case occupying the opening which, in the bladder, is filled by the wooden pin that serves for a cork.

This is, I believe, a very primitive form of vessel, although there can be no doubt that many links in the history of its development have been lost. Unlike the dug-out canoe, such a fragile contrivance as the wicker canoe perishes quickly, and no direct evidence of its ancestry can be traced at the present time. It is only by means of survivals that we can build up the past history of its development; and these are, for the most part, wanting.

The skin of an animal, flayed off the body with but one incision, served, as I have elsewhere shown, a variety of purposes: from it the bellows was derived, the bagpipes, water-vessels, and pouches of various kinds; and, filled with air, it served the purpose of a float. Steinitz, in his *History of the Ship*, gives an illustration of an inflated ox skin, which in India is used to cross rivers; the owner riding upon the back of the animal and paddling with his hands, as if it had been a living ox.

In the Assyrian sculptures there are numerous illustrations representing men floating upon skins of this kind, which they clasp with the left hand, like the tree trunks, already mentioned, that are used by the American Indians, and swim with the right. Layard says this manner of crossing rivers is still practised in Mesopotamia. He also describes the raft, composed of a number of such floats, made of the skins of sheep flayed off with as few incisions as possible; a square framework of poplar beams is placed over a number of these, and tied together with osier and other twigs. The mouths of the sheep-skins are placed upwards, so that they can be opened and refilled by the raft-men. On these rafts the merchandise is floated down the river to Bagdad; the materials are then disposed of and the skins packed on mules, to return for another voyage. On the Nile similar rafts are used, the skins being supplanted by earthen pots, which, like the skins on the Euphrates, serve only a temporary purpose, and after the voyage down the river are disposed of in the bazaars.

This mode of floating upon skins I should conjecture to be of northern origin, and to be practised chiefly by nomadic races; but we find it employed on the Morbeya, in Morocco, by the Moors, who no doubt had it from the East. It is thus described by Lempriere, in 1789. A raft is formed of eight sheep-skins filled with air, and tied together with small cords; a few slender poles are laid over them, to which they are fastened, and that is the only means used at Buluane to convey travellers, with their baggage, over the river. As soon as the raft is loaded, a man strips, jumps into the water, and swims with one hand, whilst he pulls the raft after him with the other; another swims and pushes behind. This reminds us of the custom of the Gran Chaco Indians of South America, who, in crossing rivers, use a square boat or tub of bull's hide, called *pelota*. It is attached by a rope to the tail of a horse, which swims in front; or the rope is taken in the mouth of an expert swimmer.

I have not traced the distribution of these rafts of inflated skins as continuously as, I have no doubt, they might be traced amongst nomadic and pastoral races, moving with their flocks and herds, the skins of which would be employed in this way; nor have I been able to trace the connexion which, I have no doubt, existed between the inflated skin and the open 'curragh' of wicker covered with skins. Where one is found, the other is often found with it. Herodotus describes the boats used by the people who came down the river to Babylon, and says they are constructed in Armenia, and in the parts above Assyria, thereby connecting them with the north. 'The ribs of these vessels,' he says, 'are formed of willow boughs and branches, and covered externally with skin. They are round, like a shield, there being no distinction between head and stern. They line the bottom with reeds and straw, and taking on board merchandise, chiefly palm wine, float down the stream. The boats have two oars, one to each man: one pulls and the other pushes. They are of different dimensions, some having a single ass on board and others several. On their arrival at Babylon the boatmen dispose of their goods, and offer for sale the ribs and straw; *they then load the asses with the skins*, and return with them to Armenia, where they construct new boats'—just as is now done with the inflated skins of the rafts at Baghdad.

In the Pictorial Bible an illustration is given from the Sassanian sculptures at Takht-i-Bostan of several of these round vessels, probably of wicker, covered with skins. In one of these the principal figure carries a composite bow, which, as I have elsewhere shown, is of northern origin. Mr. Layard discovered in Nimroud a sculpture in which one of these boats is represented. It is round, like those described by Herodotus; back and stern alike; carrying two people, one of whom pulls and the other pushes; and in the same sculpture are represented men swimming on the inflated sheep-skins. He says that these same round vessels are still used at Baghdad, built of boughs and timber covered with skins, over which bitumen is smeared to render it more water-tight. [Hamilton] also speaks of the same vessels (of reeds and bitumen) on the Euphrates, at the commencement of the eighteenth century.

On the Cavery, in Mysore, Buchanan, in 1800, describes ferry-boats that are called *donies*, which are circular baskets covered with leather; but whether these vessels, like the composite bow used in the same region, can be traced to a northern origin I have not the means of determining, nor have I as yet sufficient materials to enable me to ascertain whether such vessels are employed in the north of Asia at the present time. What the inflated skin is to these circular vessels, the *kayak* is to the *baidar* of the Esquimaux. Throughout the whole region occupied by this race, these two kinds of vessels are used, differing only in minute varieties of detail in the different localities. According to Dr. King, whose valuable paper, 'On the Industrial Arts of the Esquimaux,' was published in the first volume of the *Journal of the Ethnological Society* (1848), the varieties of the *kayak* in the different localities consist merely in the elevation and shape of the rim of the hole in which the man sits. In Prince William Sound, on the NW. coast, the *kayak* is frequently built with two or three holes to contain two or three men. The bow has two beaks, one of which turns up, according to Captain Cook, like the head of a violin, as represented in No. 1254 of my collection. This is also used in the Aleutian Isles. The meaning of this double beak I have not been able to ascertain. The *baidar* used on this coast has also a double beak, as represented in No. 1255 of my collection.

In the British Museum there is a *kayak* with a single opening, from Behring Straits, which differs but little from another in the same museum from Greenland; the *kayak* of Greenland has a knob of ivory at each end to protect the sharp point. The *baidar* is used at Ochotsk and Kamtschatka, on the Asiatic coast, and all along the northern coast of America, eastward from Behring Strait. Models of both *baidar* and *kayak* are in the British Museum, from Kotzebue Sound. In Frobisher Strait, Frobisher, in 1577, says the boats are of two kinds of leather stretched on frames, the greater sort open, and carrying sixteen or twenty people (the *baidar*), and the lesser, to carry one man, covered over, except in one place where the man sits (the *kayak*). In Hudson's Straits and Greenland, where the larger vessels are called *oomiak*, they are flat-sided and flat-bottomed, about three feet high, and nearly square at the bow and stern, whereas this sort on the north-west coast is sometimes pointed at bow and stern. Kerguelen, in 1767, mentions both kinds in Greenland; and Kalm, in 1747, speaks of both, though not from personal observation, on the coast of Labrador. The Esquimaux canoe has been known to have drifted from Greenland across the north of Scotland, and has been picked up, with the man still alive in it, on the coast of Aberdeen (Wilson).

In Britain the *coracle* of osier, covered with skin, is mentioned by Caesar, and in Britain, Gaul, and Italy by Lucan (A.D. 39–65). In Scotland, Bellenden, in the sixteenth century, speaks of the *currock* of wands, covered with bulls' hide, as being in use in the sixteenth century, and its representative is still used in the west of Ireland. Sir William Wilde says that, under the name of *curragh*, it is still made of leather, stretched over a wooden frame, on the Boyne, and in Arran, on the west coast, of light timber, covered with painted canvas, which has superseded the use of leather. I have seen these vessels at Dingle, on the south-west coast, where they go by the name of *nevōg*; they are there 23 feet in length by 4 in width, and 1 ft. 9 inches deep, made of laths, and covered with painted canvas; they are used, from Valentia, along the west coast as far as Galway. In the south they are larger than in the north, where they are called *curraghs*, and a single man can carry one on his back, as the ancient Briton did his *coracle*. Their continuance is caused by their cheapness, costing only £6 when new. Here also they were, until recently, constructed of leather. They have a small triangular sail, and, like the most ancient forms of vessels, they are guided, when sailing, by means of oars, one on each side.

5. *Rafts.*

The trunks of trees, united by mutual attraction, as they floated down the stream, would suggest the idea of a raft. The women of Australia use rafts made of layers of reeds, from which they dive to obtain mussel-shells. In New Guinea the catamaran, or small raft formed of three planks lashed together with rattan, is the commonest vessel used. Others are larger, containing ten or twelve persons, and consist of three logs lashed together in five places, the centre log being the longest, and projecting at both ends.

This is exactly like the catamaran used on the coast of Madras, a model of one of which is in the Indian Museum; they are also used on the Ganges, and in the Asiatic isles. At Manilla they are known by the name of *saraboas*; but the perfection of raft navigation is on the coast of Peru. Ulloa, in 1735, describes the *balzas* used on the Guayaquil, in Ecuador, and on the coast as far south as Paita. They are called by the

Indians of the Guayaquil *jungadas*, and by the Darien Indians *puero*. They are made of a wood so light that a boy can easily carry a log 1 foot in diameter and 3 or 4 yards long. They are always made of an odd number of beams, like the New Guinea and Indian rafts, the longest and thickest in the centre, and the others lashed on each side. Some are 70 ft. in length and 20 broad. When sailing, they are guided by a system of planks, called *guaras*, which are shoved down between the beams in different parts of the raft as they are wanted, the breadth of the plank being in the direction of the lines of the timbers. By means of these they are able to sail near the wind, and to luff up, bear away, and tack at pleasure. When a *guara* is put down in the fore part of the raft, it luffs up, and when in the hinder part, it bears away. This system of steering, he says, the Indians have learnt empirically, 'their uncultivated minds never having examined into the *rationale* of the thing.'

It was one of these vessels which Bartolomew Ruiz, pilot of the second expedition for the discovery of Peru, met with; and which so astonished the sailors, who had never before seen any vessel on the coast of America provided with a sail. Condamine speaks of the rafts in 1743, on the Chinchipe, in Peru. They are also used on the coast of Brazil, where they are also called *jungadas*, from which locality there is a model of one in the British Museum, and another in the Christy collection. Professor Wilson thinks it was by means of these vessels, driven off the coast of America westward, that the Polynesian and Malay islands were peopled; and this brings us to the consideration of the peculiar class of vessel which is distributed over a continuous area in the Pacific and adjoining seas, viz. the outrigger canoe, which, I shall endeavour to show, was derived from the raft.

6. *Outrigger-canoes.*

The sailing properties of the *balza*, or any other similar raft, must have been greatly impeded by the resistance offered to the water by the ends of its numerous beams. In order to diminish the resistance, the obvious remedy was to use only two beams, placed parallel to each other at a distance apart, with a platform laid on cross-poles between them.

Of this kind we find a vessel used by the Tasmanians, and described by Mr. Bonwick, on the authority of Lieut. Jeffreys. The natives, he says, would select two good stems of trees and place them parallel to each other, but a couple of yards apart; cross-pieces of small size were laid on these, and secured to the trees by scraps of tough bark. A stronger cross-timber, of greater thickness, was laid across the centre, and the whole was then covered by wicker-work. Such a float would be thirty feet long, and would hold from six to ten persons (Herbert Spencer, *Descriptive Sociology* (London, 1874), No. 3, Table V).

In Fiji, Williams describes a kind of vessel called *ulatoka*, a raised platform, floating on two logs, which must evidently be a vessel of the same description as that used in Tasmania.

From these two logs were derived the double canoe on the one hand, and the canoe with the outrigger on the other.

A link between the catamaran and the outrigger canoe is seen in a model in the India Museum, from Madras. It consists of the usual catamaran, already described, of three beams lashed together, the longest being in the centre, across which are attached, their ends extending on one side, long outrigger poles, to the extremities of which, parallel, and at some distance from the catamaran, is fastened an outrigger log, of smaller size and length, pointed at both ends, and boat-shaped, exactly like those used with the outrigger canoes to be hereafter described. When the art of hollowing out canoes was introduced, then one canoe and one log, or two canoes, were employed, as the case might be. This I consider to be a more natural sequence than to suppose the outrigger invented as a means of steadying the dug-out canoe.

The outrigger canoe, and its accompanying double canoe, is used over the whole of the Polynesian and Asiatic islands—from Easter Island on the east, to Ceylon and the Andamans on the west. Their varieties are also, in some cases, continuous; and I will endeavour to trace the distribution of each, commencing with the canoe with the single outrigger.

Towards the eastern and northern extremities of the Polynesian Islands we find that the canoes have a single outrigger, and that the ends of the outrigger poles are attached directly to the outrigger log, instead of being connected with it by upright supports, as is the case elsewhere. As the outrigger log is on a lower level than the line of the gunwales of the canoe, across which the other ends of the outrigger poles are lashed, they are generally curved downwards to meet the outrigger.

This is the form described by La Perouse in Easter Island. It is the same in the drawings of canoes from Marquesas; also in the one, figured by Wilkes, from Wytoohee or Disappointment Isle, in the Low Archipelago; and in the one from Tahiti, Society Isles; also in those of the Sandwich Isles and the Kingsmill Isles; and it reappears again on the extreme west of the group in Ceylon, No. 1265 of my collection.

But whilst this peculiarity appears to be constant in the above-mentioned region, the form of the body of the canoe differs in each group of islands. In the Marquesas the bow turns up very much, in the Sandwich Islands only slightly (No. 1264); in Disappointment Isle there is a projecting part before and behind, by which they step into it; in Tahiti they have a similar projection over the stern only, which is used for a similar purpose.

To the westward of these, in a group extending over the centre of the region in question, all the outriggers that I have seen described, either by means of models or drawings, have upright supports on the upper side, and on these the outrigger poles rest, so as to be on the level of the line of the gunwales. This is the case in Nuie or Savage Island; in Samoa (No. 1262); in the Caroline Isles; in Bowditch Island, one of the Union group; in Tonga and Fiji; in New Guinea; in the Louisiade Archipelago, and in North Australia.

Another peculiarity in this central region deserves notice. The ends of the canoe are covered with a deck extending over about one-third of its length fore and aft, and on this deck there is a row of upright pegs, carved out of the same piece as the deck, and running down the centre of it. Each peg is surmounted by a white *Cypraea ovula* shell tied on. The origin and meaning of this custom is unknown, but it was probably adopted originally as insignia of the rank of the owner. Its distribution is limited to a group of islands lying between about the 10th and 20th parallel of south latitude, and 170° and 180° west longitude. Cook, in 1773, speaks of it in the Friendly Isles; and Wilkes, in 1838, mentions it in Samoa, Fiji, and

Bowditch Island. The canoes of the Solomon Isles and other islands are, however, also ornamented with shells in different parts.

The canoe with the single outrigger is also used in [Garret Dennis Island], which is described by Dampier in 1686; in the Ladrones, by Pigafetta, 1519; in the Pelew Islands; in Borneo; in Ceylon; in the Nicobar and Andaman Islands.

In Kingsmill and the Caroline Islands, to the north, the outrigger is somewhat smaller than elsewhere, its length not exceeding one-third of the length of the canoe. In the adjoining groups of the Kingsmill and Ladrone Islands we have a variety of this vessel in which the canoe, on the outrigger side, is nearly flat, having a belly only on the opposite side. This is described by Wilkes in 1838, and Dampier in 1686.

The double canoe represents a variety in which both logs of the double-logged raft have developed into canoes. The two canoes are placed side by side, at a little distance apart, and transverse spars are lashed across the gunwales of both; a platform being built upon the cross spars; No. 1266 of my collection.

Double canoes of this kind were used in New Zealand formerly, also in New Caledonia. Mr. Baines mentions it in North Australia, but I am not aware that it is used in New Guinea. Cook speaks of it in the Friendly Isles, Wilkes in Fiji. It was formerly used in Samoa, but Wilkes says it has been discontinued, and the single outrigger only is now used; in Tahiti; in the Low Archipelago, the inhabitants of which group are very expert sailors, steering by the stars, and seldom making any material error; in the Sandwich Isles; also in Ceylon, where it is called a *paddy boat*; in Burmah and in some of the Indian rivers; at Mosapore, where it goes by the name of *langardy*; and in Cochin, on the southern portion of the Malabar coast, where it is employed as a ferry-boat. It also appears, by a model in the India Museum, that it is used as high up as Patna, on the Ganges.

In Fiji we find a connecting link between the double canoe and the canoe with the single outrigger. Here the outrigger consists of a boat, similar in construction to the large one to which it is attached, but smaller, and connected with the platform between them by upright supports.

Contrivances for sailing near the wind with the single ou rigger canoe have led to the introduction of several other varieties of this class of vessel. It is necessary that the outrigger should always be on the windward side. The outrigger acts as a weight on the windward side, to prevent the narrow canoe from being blown over on the opposite side. When it blows very hard, the men run out on to the outrigger, to give it the additional weight of their bodies. Wilkes says that whenever the outrigger gets to the leeward side, there is almost invariably an upset. The outrigger probably is pressed too deeply into the water, and meeting with too much resistance, breaks the poles. To meet this difficulty both the canoe and outrigger are, in some parts, made pointed at both ends. When they wish to tack, instead of luffing and coming about, they bear away, until the vessel gets on the opposite quarter, and then, by shifting the sail, they sail away again stern first. This system is pursued in Fiji, in parts of New Guinea, and northward, in Kingsmill Islands (Wilkes).

Another mode of meeting this difficulty consists in having two outriggers, one on each side. This is employed in the Louisiade Archipelago (No. 1260), in parts of New Guinea, and to the north, in the Sooloo Archipelago. Yet another method remains to be described. In Samoa the canoes are built with bow and stern, and the outrigger is pointed towards the fore part only. As these vessels can only sail one way, the outrigger, in tacking, must necessarily be sometimes on the leeward side; to meet this, they rig out a platform corresponding to the outrigger platform on the opposite side; this, for distinction's sake, we may term a *weather platform*. It has no outrigger log, nor does it touch the water, but when the wind blows so heavily as to press the outrigger down on the lee side, they run out on the weather platform, and counterbalance the effect of the wind by their weight. This contrivance is used in some parts of New Guinea, where, it may be observed, the varieties of the outrigger canoe are more numerous than in most of the other islands. It is also used in the Solomon Isles, where the weather platform is of the same width as the outrigger platform; and probably in some of the other islands to the north.

Finally we have, in the Asiatic Archipelago, a contrivance which may be said to be derived partly from the double outrigger, and partly from the weather platform last described. In proportion as the simple dug-out canoe began to be converted into a built-up vessel, and to acquire greater beam, they began to depend less and less on the support of the outrigger. The double outrigger necessarily presented considerable resistance to the water, but the vessel was still too narrow to sail by itself. A weather platform had, however, been found sufficient to balance the vessel on one side, and the next step was to knock off the outrigger log on the other side, thereby converting the outrigger platform into a weather platform; the two platforms projecting one on each side of the vessel, on the level of the gunwales, without touching the water, and thereby acting on the principle of the balancing-pole of a tight-rope dancer, whilst the resistance to the water was by this means confined to that of the hull of the vessel itself. These double weather-platform boats were also found more convenient in inland waters, in the canals in Manilla, and elsewhere.

De Guignes, in 1796, mentions a contrivance of this sort in the Philippines, but from the account, it is not quite clear whether he refers to a double weather platform, or a vessel with an outrigger and a weather platform. He says that the boats at Manilla are very sharply built, and furnished with yards, which serve as *balances*, on the windward side of which, when the wind blows hard, the sailors place themselves to counterpoise the effect of the wind on the sails. This contrivance does not, however, always ensure safety, for at times the bamboos which form the balance break, in which case the boat founders and the crew are lost. Dampier, however, in 1686, clearly speaks of the double weather platform at Manilla. He says that the difference between these Manilla boats and those at Guam, in the Ladrones, is that, whereas at Guam there is a little boat, fastened to the outriggers, that lies in the water, the beams or bamboos here are fastened transverse-wise to the outlayers on each side, and touch not the water like boats, but one, three, or four feet above the water, and serve for the canoe-men to sit and row and paddle upon. He says, that when the vessel reels, the ends of the platform dip into the water, and the vessel rights itself. Still further north, at Rangoon, on the Irrawaddy, we find the same contrivance described by Symes in

1795. He says that the boats are long and narrow, sixty feet in length, and not more than twelve in the widest place; they require a good deal of ballast, and would have been in constant danger of upsetting, had they not been provided with outriggers which, composed of thin boards, or oftener of buoyant bamboos, make a platform that extends horizontally six or seven feet on the outside of the boat from stem to stern. Thus secure, he says, the vessel can incline no further than until the platform touches the surface of the water, when she immediately rights; on this stage the boatmen ply their oars.

This constitutes one out of many points of evidence that might be mentioned, serving to show that the arts and culture of the Burmese, and of all this part of Asia, have been derived from the Malay Archipelago more probably than the reverse.

The outrigger canoe itself has never, I believe, been known on the Irrawaddy within the memory of man, but, as already seen, it is used in the Nicobar and Andaman Isles and on the coast to the south.

These outriggers, or balancing platforms, appear gradually to have diminished in size as the vessel increased in beam, and there can be little doubt that the rude stages or balconies outside the gunwales represented in the models of many of the larger vessels used in these seas are the last vestiges of the outrigger. No. 1278 of my collection is an example of this.

7. *Rudders, Sails, and other Contrivances.*

All the various items of evidence which I have collected, and endeavoured to elucidate by means of survivals, whether in relation to modes of navigation or other branches of industry, appear to me to tend towards establishing a gradual development of culture as we advance northward. Although Buddhism and its concomitant civilization may have come from the north, there has been an earlier and prehistoric flow of culture in the opposite direction—northward—from the primaeval and now submerged cradle of the human family in the southern hemisphere. This, I venture to think, will establish itself more and more clearly, in proportion as we divest ourselves of the numerous errors which have arisen from our acceptance of the Noachian deluge as a universal catastrophe.

As human culture developed northward from the equator toward the 40th parallel of latitude, civilization began to bud out in Egypt, India, and China, and a great highway of nations was established by means of ships along the southern margin of the land, from China to the Red Sea.

Along this ocean highway may be traced many connexions in ship forms which have survived from the earliest times. The *oculus*, which, on the sacred boats of the Egyptians, represented the eye of Osiris guiding the mummy of the departed across the sacred lake, is still seen eastward—in India and China—converted into an ornamental device, whilst westward it lived through the period of the Roman and Grecian *biremes* and *triremes*, and has survived to this day on the Maltese rowing-boats and the *xebecque* of Calabria, or has been converted into a hawser-hole in modern European craft. The function of the rudder—which in the primitive vessels of the southern world is still performed by the paddlers, whilst paddling with their faces to the prow—was confided, as sails began to be introduced, to the rearmost oars. In some of the Egyptian sculptures the three hindermost rowers on each side are seen steering the vessel with their oars. Ultimately one greatly developed oar on each side of the stern performed this duty; the *loom* of which was attached to an upright beam on the deck, as is still the case in some parts of India. In some of the larger Malay *prahaus* there are openings or windows in the stern, considerably below the deck, by which the steersmen have access to two large rudders, one on each side; each rudder being the vestige of a side oar.

Throughout the Polynesian Islands the steering is performed with either one or two greatly developed paddles. Both in the rudder of the Egyptian sculptures and in the *gubernaculum* of the Roman vessels, we see the transition from the large double oar, one on each side, to the single oar at the stern. The ship of Ptolemaeus Philopator had four rudders, each thirty cubits in length (Smith's *Dict.*, s. v. 'Navis'). The Chinese and Japanese rudder is but a modification of the oar, worked through large holes in the stern of the vessel; which large holes, in the case of the Japanese, owe their preservation to the orders of the Tycoon, who caused them to be retained in all his vessels, in order to prevent his subjects from venturing far to sea. The *buccina*, or shell trumpet, which is used especially on board all canoes in the Pacific, from the coast of Peru to Ceylon, is represented, together with the *gubernaculum*, in the hands of Tritons in Roman sculptures (Smith's *Dict.*, s. v. 'Navis'), and the shell form of it was preserved in its metallic representatives.

The sail, in its simplest form, consists of a triangular mat, with bamboos lashed to the two longer sides. In New Guinea and some of the other islands, this sail, which is here seen in its simplest form, is simply put up on deck, with the apex downwards and the broad end up, and kept up by stays fore and aft. When a separate mast was introduced, this sail was hauled up by a halyard attached to one of the bamboos, at the distance of about one-fifth of its length from the broad end, the apex of the bamboo-edged mat being fastened forward by means of a tack. By taking away the lower bamboo the sail became the *lateen* sail of the Malay pirate *proa*, the singular resemblance of which to that of the Maltese galley of the eighteenth century (a resemblance shared by all other parts of the two vessels) may be seen by two models placed side by side in the Royal United Service Institution. Professor Wilson observes that the use of the sail appears to be almost unknown on either continent of America, and the surprise of the Spaniards on first seeing one used on board a Peruvian *balza* arose from this known peculiarity of early American navigation (p. 218). Lahontan, however, in 1684, says that the Canadian bark canoes, though usually propelled by paddles, sometimes carried a small sail. He does not, however, say whether the knowledge of these has been derived from Europeans. Mr. Lloyd also mentions small sails used with bark canoes in Newfoundland.

The *crow's-nest*, which in the Egyptian vessels served to contain a slinger or an archer at the top of the mast, and which is also represented in the Assyrian sculptures, was still used for the same purpose in Europe in the fifteenth century, was modified in the sixteenth century, and became the mast-head so well known to midshipmen in our own time. The two raised platforms, which in the Egyptian vessels served to contain the man with the fathoming pole in the fore part, and the steersman behind, became the *prora* and the *puppis* of the Romans, and the *forecastle* and *poop* of modern European vessels. The *aplustre*, which, in the form of a lotus, ornamented the stern of the Egyptian war-craft, gave the form to the *aplustre* of the Greeks and Romans, and may still be seen on the stern of the Burmese war-boats at the present time.

All these numerous examples serve to show that where civilization has advanced the forms have been gradually changed; where, on the other hand, it has not advanced, they have remained unchanged. Sir Gardner Wilkinson and others have pointed out the striking resemblance between the boats of the ancient Egyptians and those of modern India. 'The form of the stern, the principle and construction of the rudder, the cabins, the square sail, the copper eye on each side of the head, the line of small squares at the side, like false windows, and the shape of the oars of boats used on the Ganges, forcibly call to mind,' he says, 'those of the Nile, represented in the paintings of the Theban tombs.' We have also seen (p. 214) that the inflated sheep-skin still serves to transport the Mesopotamian peasant across the Euphrates, as it did when Nimroud was a thriving city. The skin and wicker tub-shaped vessels still float down the Euphrates with their cargoes to Baghdad, are broken up, and the skins carried up the river again on mules, as they were in the time of Herodotus, upwards of 2,000 years ago. What is there to prevent our believing that the primitive vessels which we have been describing in the southern hemisphere, the representatives of some of which have been discovered in river deposits of the stone age in Europe, may have been in use in the countries in which they are now found, as long, and longer—far longer?

What reason is there to doubt that the rude bark-float of the Australian, the Tasmanian, and the Ethiopian; the catamaran of the Papuan; the dug-out of the New Zealander; the built-up canoe of the Samoan; and the improved ribbed vessel of the Ke islander, are survivals representing successive stages in the development of the art of ship-building, not lapses to ruder methods of construction as the result of degradation; that each stage supplies us with examples of what was at one time the perfection of the art, inconceivable ages ago? Some, as we have seen, especially the more primitive kinds, spread nearly all over the world, whilst others had a more limited area of distribution. Taken together, they enable us to trace back the history of ship-building from the time of the earliest Egyptian sculptures to the commencement of the art.

Nor does the interest of this inquiry confine itself to the development of ship-building. As affecting the means of locomotion, it throws light on the development of other branches of culture in early times. For even if we set aside exceptional instances in which individual canoes have been driven away to great distances—such as the case in which an Esquimaux in his kayak was picked up off the coast of Aberdeen, or that of a Chinese junk having been wrecked on the north-west coast of America, which might or might not have produced permanent results—and confine ourselves to those cases in which the distribution of like forms of vessels proves that there must probably have been frequent communication between shore and shore; and if we further assume, as I propose to do, that the existing means of communication in the Pacific in a great measure represents the amount of intercourse that took place across the sea in prehistoric times, that is to say, in times prior to the earliest Egyptian sculptures, we find no difficulty in accounting, by this means, for the striking similarity observable in the arts and ideas of savages in distant lands; for not only have these vessels been the means of conveying from place to place the material form of implements, such as celts, stone knives, and so forth, which, being imperishable, have been handed down to us unchanged, and the forms of which we know to have spread over large geographic areas; but also each voyage has conveyed a boat-load of ideas, of which no material record remains, in the shape of myths, religions, and superstitions, which have been emptied out upon the seashore, to seek affinity with other chatter that was indigenous to the place.

Thus, by means of intercommunication, no less than by spontaneous development, have been formed those numerous combinations which so greatly puzzle the student of culture at the present time.

NOTES TO 'EARLY MODES OF NAVIGATION'

P. 189. Steinitz, *The Ship: its Origin and Progress* (London, 1849), Pl. ii (frontispiece): cf. pp. ix, 4.

Gregory, 'Expedition to the NW. coast of Australia,' *Roy. Geogr. Soc. Journal*, xxxii. (1862) p. 376.

P. 190. Cook, *Voyages* (ed. London, 1842), vol. i. p. 204.

Kitto, *Pictorial Bible*, note on 2 Sam. xix. 18.

Pliny, ix. 10 (cf. vi. 24); Diodorus, iii. 21, 5; Strabo, p. 773; turtle-shell boats were in actual use among the 'Turtle-eaters' (*Chelonophagi*) of Carmania and the islands of the Red Sea.

P. 191. Kalm, *Travels into North America* (London, 1771), vol. ii. pp. 38–9.

Raleigh's Expedition; Amadas and Barlawe, *The First Voyage to the Coasts of America* (=Pinkerton (1811), vol. xii. p. 567).

Columbus, *The Journal of Christopher Columbus, &c.*; transl. Markham (Hakluyt Society, 1893), p. 39, mentions dug-out canoes (cf. pp. 58, 94), but not the use of fire.

Mouat, *Adventures and Researches among the Andaman Islanders* (London, 1863), pp. 315–6; only hand-hollowing in use in his time: no mention of Blair here: perhaps a verbal communication to the author.

Symes, *An Account of an Embassy to the Kingdom of Ava* in 1795 (London, 1800), p. 320 (=Pinkerton (1811), vol. ix. p. 500).

Turner, *Nineteen Years in Polynesia* (London, 1861), pp. 425–6.

P. 192. Wood, *Natural History of Man* (London, 1868–70), vol. ii. p. 732.

P. 193. Wilkes, *United States Exploring Expedition* (Philadelphia, 1845), vol. ii. p. 150 (Samoa); vol. v. p. 322 (Manilla); vol. v. p. 353 (Sooloo).

De Guignes, *Voyages à Peking, Manille, et l'Ile de France* (Paris, 1808), vol. iii. p. 402.

De Morga, *The Philippine Islands* (1609); transl. by Hon. H. E. Stanley (Hakluyt Society, 1868), p. 272; two types, (*a*) 'made of one very large tree'; (*b*) 'also *vireys* and *barangays* . . . joined together with wooden bolts.'

Symes, *An Account of an Embassy to the Kingdom of Ava* in 1795 (London, 1800), p. 320 (=Pinkerton (1811), vol. ix. p. 500).

P. 194. Turpin, *Histoire de Siam* (Paris, 1771), vol. i. pp. 34–6.

Pietro della Valle, *Viaggi* (Brighton, 1843), vol. i. pp. 602–3.

Duarte Barbosa (Magellan), *A Description of the Coasts of East Africa and Malabar* (1514); transl. by Hon. H. E. Stanley (Hakluyt Society, 1866), p. 9.

Livingstone, *Missionary Travels and Researches in South Africa* (London, 1857), p. 64.

Barth, *Travels and Discoveries in North and Central Africa* (London, 1857), vol. ii. p. 469; the tributary is the *Faro*; Yola is the adjacent town.

Grant, *Walk across Africa* (London, 1864), p. 304.

Condamine, M. de la, *Relation abrégée d'un voyage fait dans l'intérieur de l'Amérique méridionale* (Paris, 1745), p. 63 (at Laguna).

P. 195. Wilson, *Prehistoric Man* (London, 1862), vol. i. p. 169.

Bartram, *Travels through N. and S. Carolina, Georgia, &c.* (London, 1792), p. 225.

Kalm, *Travels into N. America* (London, 1771), vol. ii. pp. 240–2.

Pliny, xvi. 40 *Germaniae praedones singulis arboribus cavatis navigant, quarum quaedam et triginta homines ferunt.*

Keller, *Lake Dwellings of Switzerland* (transl. by J. E. Lee, 2nd ed., 1878), p. 45, Pl. x. 8.

Sir W. Wilde, *Catalogue of the Antiquities of the Museum of the Royal Irish Academy* (Dublin, 1863), vol. i. pp. 202–4.

Ware, *The Antiquities and History of Ireland* (London, 1705), p. 47.

Wilson, *Prehistoric Man* (London, 1862), vol. i. pp. 153, 160.

P. 197. Cook, *Voyages* (London, 1842), vol. i. p. 193.

P. 197. Barth, *Travels* (London, 1857), vol. ii. p. 469.

Byron, *An Account of the Voyages undertaken . . . for making Discoveries in the Southern Hemisphere . . . by Commodore Byron, &c.*, by John Hawksworth (London, 1773), vol. i. p. 79.

P. 198. Duarte Barbosa, *A Description*, &c. (Hakluyt Society, 1866), pp. 14–15.

Denham and Clapperton, *Travels in Northern and Central Africa* (London, 1826), p. 60 (Denham).

Barth, *Travels* (London, 1857), vol. iii. p. 293.

Grant, *Walk across Africa* (London, 1864), p. 196.

P. 199. Cook, *Voyages* (1842), vol. i. p. 425 (Friendly Islands); pp. 95–7 (Otaheite).

La Perouse, *Voyage autour du monde* (Paris, 1897), Atlas, No. 61.

Wilkes, *United States Exploring Expedition* (Philadelphia, 1845), vol. i. pp. 331-2 (Wytoohee); vol. ii. p. 157 (Samoa).

P. 200. Williams, *Fiji and the Fijians* (London, 1858), vol. i. pp. 71–6.

Wilkes, l. c., vol. v. p. 52.

Wallace, *The Malay Archipelago* (London, 1869), vol. ii. p. 159 (the long journey); p. 92 (nail-less boats); pp. 183–6 (the Ke islanders). [The author's text has been amended to conform with the statements of Wallace.—Ed.]

P. 201. Dampier, *A New Voyage round the World* (London, 1729), vol. i. p. 429.

Turpin, *Histoire de Siam* (Paris, 1771), vol. i. p. 86.

P. 202. Duarte Barbosa (Magellan), *A Description*, &c. (Hakluyt, 1866), pp. 147-8.

Marco Polo, *Travels*, transl. by Sir H. Yule (London, 1903), vol. i. p. 108.

P. 203. Lobo, *A Voyage to Abyssinia* (London, 1735), p. 24.

Isaiah xviii. 2; see Kitto's *Pictorial Bible*, note on 2 Sam. xix. 18.

P. 204. Wilson, *Prehistoric Man* (1862), vol. i. p. 169.

Sir Gardner Wilkinson, *The Manners and Customs of Ancient Egypt*, 3rd ed., 1878, vol. ii. p. 208, No. 403 (No. 399, 1st ed.).

Lucan, *Pharsalia*, iv. 136 *Conseritur bibula Memphitica cymba papyro.*

Plutarch, *de Iride et Osiride*, 18.

Pliny, vii. 56 *Nave primus in Graeciam ex Aegypto Danaus advenit: ante ratibus navigabatur, inventis in Mari Rubro inter insulas a rege Erythra* (cf. ix. 10, and note on p. 190 above). *Reperiuntur, qui Mysos et Troianos priores excogitasse, cum transirent adversus Thracas. Etiam nunc in Britannico Oceano vitiles corio circumsutae fiunt: in Nilo ex papyro, et scirpo, et arundine.* [The quotation, as given in *J.A.I.*, iv. 414, is inaccurate.—Ed.]

Huxley, *Trans. Int. Congr. Preh. Arch.*, Norwich, 1868 (London, 1869), p. 92; see also p. 147 above.

P. 205. Owen, *Journ. Anthrop. Inst.*, vol. iv. p. 240.

Rosellini, *Monumenti dell' Egitto e della Nubia* (Pisa, 1834), Mon. Civ., Pl. cxix. 1, cxvii. 3 (=Plate XV. 109-11 herewith).

P. 206. Prideaux; Markham, *A History of the Abyssinian Expedition, with a chapter . . . by Lieut. W. F. Prideaux* (London, 1869), p. 101.

Denon, *Voyages dans la Basse et la Haute Égypte* (London, 1807), vol. ii. p. 72.

Belzoni, *Narrative of Operations and Recent Discoveries . . . in Egypt and Nubia* (London, 1820), p. 62; (holds nine persons).

Bruce, *Travels to Discover the Source of the Nile* (London, 1790), vol. v. p. 6.

P. 207. Pliny, xiii. 2 refers to wooden boats; v. 2 to wickerwork: *ibi Aethiopicae conveniunt naves: namque eas plicatiles humeris transferunt, quoties ad cataractas ventum est.*

Belzoni, *Narrative of Operations* (London, 1820), pp. 380-1.

Pliny, v. 2 (above). Lucan, *Phars.* iv. 136 (above).

Herodotus, ii. 96. Wilkinson (Birch), 3rd ed., vol. ii. p. 307.

P. 208. Homer, *Odyssey*, v. 241-261. Smith, *Dict. Gr. and Rom. Antiq.*, s. v. 'Navis.'

Nydam boat. Engelhardt, *Denmark in the Early Iron Age* (London, 1866), pp. 29-39, Pl. i-iv.

Tacitus, *Germania*, 44.

P. 210. Regnard, *Œuvres* (Paris, 1854), vol. i, *Voyage de Laponie*, pp. 51, 100.

Outhier, *Journal d'un Voyage au Nord, en* 1736 *et* 1737 (Paris, 1744), pp. 60–1.

Bell, *Travels from St. Petersburg in Russia to diverse parts of Asia* (Glasgow, 1763), vol. i. p. 168 ff.

Atkinson, *Oriental and Western Siberia* (London, 1858), pp. 14–15.

P. 211. Belzoni, *Narrative of Operations, &c. . . . in Egypt and Nubia* (1820), p. 62.

P. 212. Wilkes, *U. S. Exploring Expedition* (Philadelphia, 1845), vol. i. p. 127. [Pritchard.]

Kalm, *Travels into North America* (London, 1771), vol. ii. p. 298.

Lahontan, *New Voyages to North America* (London, 1735), vol. i. pp. 26–9.

P. 213. Lane-Fox (Pitt-Rivers), *Report of the British Association*, Brighton, 1872 (London, 1873), p. 163.

Steinitz, *The Ship: its Origin and Progress* (London, 1849), Pl. xvi. 6.

P. 214. Layard, *Nineveh and its Remains* (7th ed., London, 1848), vol. ii. pp. 381–2. Cf. Herodotus, i. 194.

Lempriere, *A Tour from Gibraltar to Tangier* (London, 1793), p. 421.

P. 215. Herodotus, i. 194.

Kitto, *Pictorial Bible*, note on 2 Sam. xix. 18. Layard, l. c.

Hamilton (Alexander), *A New Account of the East Indies*, 1688–1723 (Edinb. 1727), vol. i. p. 88. They are described, even later, by Sir R. K. Porter, *Travels in Georgia*, &c., 1817–20 (London, 1821–2), vol. ii. p. 260; and figured in Rawlinson, *Herodotus* (1862), vol. i. p. 268, after Chesney, *Expedition for the Survey of the Euphrates and Tigris* (London, 1850), vol. ii.

Buchanan, *A Journey from Madras through the countries of Mysore, Canara, and Malabar* (London, 1807), vol. ii. pp. 121, 141, 151, 163.

P. 216. Cook, *Voyages* (London, 1842), vol. ii. pp. 303–4.

Frobisher, *The Three Voyages of Martin Frobisher*, ed. Collinson (Hakluyt Society, 1867), p. 384.

Kerguelen, *Relation d'un voyage dans la mer du Nord* (Paris, 1771), pp. 178–9.

Kalm, *Travels into North America* (London, 1771), vol. ii. p. 241; iii. p. 16.

Wilson, *Prehistoric Man* (London, 1862), vol. i. p. 148.

P. 217. Caesar, *de Bello Civili*, i. 54.

Lucan, *Pharsalia*, iii. 131–5.

Bellenden, *The History and Chronicles of Scotland*, &c. 1536 (Edinburgh, 1821), vol. i. p. lix.

Sir W. Wilde, *Catalogue . . . of the Royal Irish Academy* (Dublin, 1863), vol. i. p. 204.

Ulloa, *A Voyage to South America*, 1735 (London, 1807), vol. i. pp. 182–5.

P. 218. Bartolomew Ruiz. See Benzoni, *Historia del Mondo Nuovo* (Venice, 1572), p. 165 (figure): reproduced in Benzoni (ed. Smyth: Hakluyt Soc., 1857), p. 243: cf. Winsor, *Narrative and Critical History of America* (London, 1886), vol. ii. p. 508 (figure).

Condamine, M. de la, *Relation abrégée d'un voyage fait dans l'intérieur de l'Amérique méridionale* (Paris, 1745), p. 30 (on the Maranon, not the Chinchipe R.). 'Un exprès que j'avois dépêché de Tupenda . . . avoit franchi tous ces obstacles sur un petit radeau fait avec deux ou trois pièces de bois, ce qui suffit à un Indien nud et excellent nageur, comme ils le sont tous.'

Wilson, *Prehistoric Man* (London, 1862), vol. i. p. 177.

P. 219. Bonwick, *Daily Life of the Tasmanians* (London, 1870), p. 51.

Williams, *Fiji and the Fijians* (London, 1858), vol. i. p. 76.

P. 220. La Perouse, *Voyage autour du monde* (Paris, 1797), vol. ii. p. 94.

Wilkes, *U. S. Exploring Expedition* (Philadelphia, 1845), vol. i. p. 331.

Cook, *Voyages* (London, 1842), vol. i. p. 425.

Wilkes, l. c., vol. ii. p. 151 (Samoa); iii. pp. 365–6 (Fiji); v. pp. 11–12 (Bowditch Island).

P. 221. Dampier, *A New Voyage round the World* (London, 1729), vol. i. p. 215 (at Guam in the Ladrones; elsewhere he notes them 'only at Mindanao' in the Philippines, pp. 298–300).

P. 221. Pigafetta, *Voyage round the World* (= Pinkerton (1811), vol. xi. p. 325).
Wilkes, *U.S. Explor. Exped.* (Philadelphia, 1845), vol. v. p. 52 (Kingsmill Is.).
Dampier, *A New Voyage, &c.* (1729), vol. i. p. 298 (Kingsmill Is., and Ladrones).
Baines, quoted in Wood, *Nat. Hist. of Man* (London, 1868), vol. ii. p. 8.
Cook, *Voyages* (London, 1842), vol. i. p. 425.
Wilkes, l. c., vol. iii. p. 365 (Fiji); ii. p. 151 (Samoa).
P. 222. Wilkes, l. c., vol. iii. p. 365 (Fiji); v. p. 52 (Kingsmill).
P. 223. De Guignes, *Voyages à Peking, Manille, et l'Ile de France* (Paris, 1808), vol. iii. p. 402.
Dampier, *A New Voyage round the World* (London, 1729), pp. 298–300.
Symes, *An Account of an Embassy to the Kingdom of Ava* in 1795 (London, 1800), p. 228 (= Pinkerton (1811), vol. ix. p. 455).
P. 226. Wilson, *Prehistoric Man* (London, 1862), vol. i. p. 175.
Lahontan, *New Voyage to North America* (London, 1735), vol. i. p. 28.
Lloyd, *Journ. Anthrop. Inst.*, vol. iv. p. 28.
P. 227. Wilkinson (Birch), *Manners and Customs of the Ancient Egyptians* (3rd ed., London, 1878), vol. ii. p. 219.

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